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# Sexual Size Differences in Reptiles

By
**Henry S. Fitch**

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By

Henry S. Fitch
*Museum of Natural History*
*and*
*Department of Systematics and Ecology*
*University of Kansas*
*Lawrence, Kansas 66045*



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# INTRODUCTION

The kinds of vertebrates that have males and females of just the same average size are a minority. More often one sex or the other is larger. There are varying degrees of size difference, with a relatively large number of kinds having only slight sexual differences and relatively few kinds having major differences between the sexes. The present study was undertaken to clarify these relationships in reptiles.

Sexual size differences are better known in other groups of vertebrates than in reptiles. In fishes and amphibians females are usually larger than males, but there are noteworthy exceptions. In both birds and mammals males are usually larger than females. In birds the most outstanding exceptions are the raptors, both Falconiformes and Strigiformes, in which females are larger in varying degrees (Hill, 1944; Amadon, 1959). However, those raptorial birds that are mainly carrion-eaters or insectivores tend to have similar sized sexes, and the size difference is greatest in those kinds that take relatively large prey. In these predators the female takes larger kinds of prey, on the average and as a result the pair jointly occupying a territory, utilizes a wider range of prey which facilitates the securing of sufficient food, particularly during the critical period when nestlings are being fed. In accipitrine hawks Reynolds (1972) showed that the small male provides prey for the female during incubation and for the nestlings during the early stages of their growth, allowing the female to spend her time at the nest, protecting the brood against extremes of weather and predators; in the late stages of nestling growth, when the nestlings' need for food is maximal, the female is active in hunting, and provides relatively large prey items.

In mammals 84 species of 12 orders and about 30 families are known to have females larger than males (Ralls, 1976). Mammalian groups that consistently have females larger include vespertilionid bats, rabbits (leporids), three families of baleen whales, lobodontine seals, and cephalophine and neotragine antelopes. These diverse groups seem to have no common traits such as polyandry, strongly developed female aggression, development of female weapons, or female dominance or matriarchy, that would account for the larger size of females.

Presumably the mean adult size of each species and the size relationships of its sexes are the products of a complex of selective pressures that change through time. Optimum adjustment to available food, shelter, and other environmental factors is involved. Some selective factors that might cause one sex or both sexes to deviate from modal adult size are: 1) need for the male to dominate potential mates and/or rivals; 2) need for the female to alter her reproductive strategy; 3) need for the species to reduce intraspecific (intersexual) competition for food and perhaps for other resources. Each species, in its unique ecological niche, has presumably been influenced by its own peculiar set of selective pressures.

The present study is a preliminary attempt to show general trends of sexual size differences in living species of the class Reptilia, and to determine causes and correlations for them. Most previous studies (e.g., Klauber, 1943; Shine, 1978b) have not undertaken to show the amount of sexual size difference, but have merely stated that one sex or the other was the larger. No survey for the group as a whole has been made heretofore, but a number of authors have indicated sexual size differences in individual species. In the iguanid lizard genera *Anolis* and *Sceloporus* I determined sexual size differences for a large number of species (Fitch, 1976, 1978) and indicated various ecological factors

that affected them; Schoener (1970) and Schoener and Schoener (1971a, 1971b) likewise determined sexual size relationships in many species of Antillean *Anolis*. However, my present study is a preliminary one because all figures obtained are in need of revision and/or refinement. Some data are based on inadequately small samples. Literature records are sometimes based upon different kinds of data, hence widely disparate figures have been obtained for the same kind of animal in a few instances. As data have accumulated, it has become evident that the sexual size difference of a species is subject to variation in time and space, and perhaps cannot be represented adequately by a single figure.

## ACKNOWLEDGMENTS

The data that are the basis for this report were accumulated in the course of field work and museum studies over a 30-year period. W. Frank Blair (University of Texas, Texas Natural History Collection), Charles M. Bogert (American Museum of Natural History), W. E. Duellman (University of Kansas, Museum of Natural History), and Robert C. Stebbins (University of California, Museum of Vertebrate Zoology) kindly permitted examination of specimens in the collections under their care. Many persons assisted me in capturing the animals measured alive in the field, and in other ways; special thanks are due to Anthony A. Echelle, Alice Fitch Echelle, Chester W. Fitch, David C. Fitch, Virginia R. Fitch, Robert R. Fleet and Robert W. Henderson. My wife, Virginia R. Fitch, also helped me in various stages of gathering and analyzing the data and preparing the manuscript. Richard Shine shared with me the early planning of the study. Richard A. Seigel kindly contributed unpublished data concerning sizes in *Malaclemys*, Lawrence E. Hunt likewise contributed measurements for two kinds of *Anniella*. The following authors generously made available material from their unpublished manuscripts: Hugo Hidalgo, Tsutomu Hikida, John B. Iverson, D. R. Jackson and R. Franz, Michael V. Plummer and D. B. Farrar. Alan E. Leviton kindly advised me concerning the correct names of various Asiatic species. W. E. Duellman kindly made available his measurements of Ecuadorian snakes and lizards, including substantial series of many species from Santa Cecilia and other localities in the Amazon Basin. These are indicated in Appendix I by the abbreviation "WED ms."

## METHODS AND MATERIALS

Data pertaining to sexual size differences were collected during the course of field studies of several dozen local populations, in Kansas, Mexico and Costa Rica, and by examining museum specimens in the University of Kansas Museum of Natural History, the University of California Museum of Vertebrate Zoology, the American Museum of Natural History and the University of Texas Natural History Museum. Also, figures for many species were obtained from published literature. Most publications contained pertinent information on only one or a few species but some had relatively large amounts of information. Much information about African snakes was obtained from Laurent (1956, mostly maxima), FitzSimons (1962, maxima only), and Pitman (1974, maxima only). Likewise M. Smith (1943) presented much information about Indian snakes (maxima only) as did Wright and Wright (1957) for North American species (maxima and minima). Useful papers on entire herpetofaunas were those of Fuhn and Vancea (1961) for Romania (means), Dixon and Soini (1975 and 1977) for Amazonian Perú (maxima and minima), Duellman (1978) for Amazonian Ecuador and Hoogmoed (1973) for Surinam (means for some). Two exceptionally useful papers were those of Kopstein (1941) on Malayan snakes and Schwaner (1980) on Samoan skinks and geckos, both providing large series of individual

measurements for many species. Ernst and Barbour (1972) provided the source of much information on turtles. Information on specific groups of reptiles was obtained from the works of Blanchard (1921) on king snakes (with individual measurements), Dixon and Huey (1970) on South American geckos of the genus *Phyllodactylus* (means), and Klauber (1937) on rattlesnakes (means) and especially Schoener (1970) and Schoener and Schoener (1971a and 1971b) on West Indian anoles (means).

Male and female size was compared in the species studied by averaging all the adult measurements available for each sex. For snakes, lizards and crocodilians the measurements used were those of snout-to-vent (S-V) in nearly all instances, but a few figures from the literature were based on total lengths including tail. Tails are relatively longer in male reptiles than in females, so inclusion of the tail measurement would increase the apparent sexual size difference in kinds having relatively large males but would reduce or nullify it in kinds having relatively large females. Many authors indicated total lengths for individual specimens, and the ratio of tail length to total length. In such instances I calculated snout-vent length for each specimen by subtracting tail length, assuming its tail ratio was the same as the mean for the series, but doubtless with loss of precision. Some authors showed the lengths S-V of individuals or classes in histograms without presenting actual figures; I undertook to convert data from these graphs to the original figures. In turtles the length measurements used were those of the carapace for most species and those of the plastron for some others.

Females of different reptile species investigated ranged from about ⅔ to 2½ times mean male length. Since bulk increases as the cube of linear dimensions, it is implied that females weighed from about one-fourth to about 15 times as much as their male counterparts. Differences between the sexes in specific gravity and in bodily proportions, which might affect the accuracy of relative weight calculations based on linear measurements, are probably of minor significance in most instances. Relatively few authors have recorded actual weights for reptiles, but such data are highly desirable.

Determining the lower limits of adult size was critical. In females, pregnancy or production of yolked follicles was considered adequate proof of sexual maturity. Likewise in males production of sperm was a valid criterion. However, in practice it was often not possible to check live animals or museum specimens for eggs or sperm. Instead, the development of various secondary sexual characters were relied upon. Also, the maximum size for each sex and the size distribution of a series were taken into account in deciding upon the minimum size to be included as adults. Inasmuch as small (younger) adults were usually much more numerous than large (older) adults whose cohorts had been reduced by normal mortality factors, the curve for each series tended to be skewed, with mean nearer the lower end. Even a small change in the minimum size included might have had important effect on the mean.

The following abbreviations have been used:

*SSD* = *sexual size difference*
*FMR* = *female-to-male ratio*

The latter was the linear measurement of snout-vent length, or shell length always expressed as a per cent; for example male S-V = 350 mm, female S-V = 400 mm, FMR = 400/350 = 114; or, as a second example, male S-V = 400 mm, female S-V = 360 mm, FMR = 360/400 = 90. The figure for FMR has in all instances been rounded to the nearest whole number.

Under *Results* such figures, based on averages for series of adult males and females, are presented for many species.

These figures, obtained from a variety of sources, mostly from published literature, represent four degrees of reliability. The most reliable are those figures based on the means of large statistical series (sometimes several hundred). Such records are distinguished in the lists by having both the name of the species and the figure representing its FMR set in bold face. Less reliable are figures based on means from fewer than ten measurements for either sex. These are distinguished by the symbol $\bar{x}$ following the FMR figure. Thirdly, there are figures based on the FMR for the modes, when the author had indicated only the maximum and minimum measurements for adults of each sex. For example: male S-V = 250 to 350 mm (mode 300), female = 300-400 (mode 350), FMR = 350/300 = 117. Such records are designated by the letter "m" following the FMR figure. Even less reliable are ratios obtained from maximum measurements for each sex. Such figures are included only where it is believed that the author measured a substantial series of each sex, but often the number of specimens was not mentioned. Eliminating all such instances would have assured more consistent trends, but also would have eliminated many important groups for which no information was available otherwise. In order to avoid a spurious impression of accuracy, the actual FMR figures obtained from maximum measurements have not been presented, but instead a code has been substituted, as follows:

*FMR > 135:* ++++
*FMR 126-135:* +++
*FMR 116-125:* ++
*FMR 106-115:* +
*FMR 96-105:* X
*FMR 86-95:* –
*FMR 76-85:* ––
*FMR 66-75:* –––
*FMR < 66:* ––––

The 548 taxa for which only maximum measurements for each sex are available are listed in Appendix II. In general these figures are considered to be useful at least for showing which sex is the larger, and whether SSD is large or small. They show significant trends in groups for which, otherwise, little information is available. For instance in the Asiatic *Trimeresurus*, 13 species were shown to have females larger, three species had the sexes about equal and only one was shown to have the male larger, in records mostly obtained from Smith (1943).

Most samples that were used consist of statistical series of each sex reported in the literature, and usually the series represent a single locality or area. In a few instances it was necessary to combine measurements published by two or more authors; for several species of African snakes, means were obtained by combining figures of several authors including Broadley and Cock (1975), FitzSimons (1962), Laurent (1956), Loveridge (1953), Pienaar (1966), Pitman (1974), Schmidt (1923) and de Witte (1953), in various combinations. Each of these authors published the maximum figures for the series available to him, and the means for these maxima are, of course, relatively high, compared with means from randomly selected series that are available for most other species. Likewise for several Asiatic snakes, averages were obtained from maximum measurements published by Pope (1935), Smith (1943), Malnate (1962), and others.

In general, however, the figures in Appendix I are believed to be representative for each of the species in showing the approximate mean sizes of adults of both sexes and the usual range. Appendix I will no doubt have some usefulness in showing typical sizes for various species, since definitive statements about size are remarkably scanty in the literature. Even revisionary studies which treat lepidosis and body proportions in great detail usually contain no useful information concerning size. Often the only statement about size is that of the total length of the largest specimen

examined (sometimes with no indication of its sex). Herpetologists have been prevented from fully utilizing size in systematic studies by the dogmatic conviction that in reptiles growth is "indeterminate." Actually the genetic size differences between species and subspecies could, in my opinion, provide some of the most useful taxonomic characters. In general, adult size in a reptile species is more variable than it is in a bird or mammal, but less so than in a fish. Adult size tends to be relatively homogeneous in turtles and lizards, less so in snakes; but within each of these groups there is much difference between families, genera and species in homogeneity of adult size.

In the annotated systematic listing, under *Results,* binomials are used (regardless of subspecies) when only one population of a species was sampled, or for the nominate subspecies if other populations of the species are listed separately.

The maximum sizes listed in the appendices include few "world records" if any. They merely represent the largest male and female in the particular series utilized, and almost inevitably larger specimens will be found if they are not already known.

Although most FMR figures were obtained from random samples of adults, there were several important exceptions. The figures for many West Indian anoles, from Schoener (1970) and Schoener and Schoener (1971a and 1971b) were based on the one-third of the adults of each sex that were the largest in each sample. The figures for Conant's (1969) Mexican *Nerodia* were based on the 10 largest males and females of each sample. In a few instances, disregarding trinomials and minor geographic variants, I averaged the maxima for several geographical populations to obtain a series (e.g., Schwartz, 1970). In a few instances as for the several African snakes the maximum measurements for each sex published by various authors were combined to average for FMR.

A series of specimens showing a sexual size difference usually has more difference between the maxima than between the means, that is, the difference between the male and female means tends to be magnified in the maxima. The trend of relationship between means and maxima are shown in Table 1. Even if the means are just the same, one sex or the other may grow to a larger maximum size.

## RESULTS

The large amount of data obtained bearing on sexual size differences in reptiles has revealed some significant trends within and between various taxonomic groups. Also it has raised many problems that are not readily answered. For most reptile species knowledge of life history and ecology is still insufficient to interpret SSDs in terms of reproductive strategies, $r$ and $K$ selection or other appropriate concepts.

Ontogenetic changes in sexual size differences are revealed for several species. For several others, geographic variation in SSD is shown. In some cases SSD can be strongly correlated with behavioral or reproductive traits or with climatic preferences.

Table 1 shows FMR figures for 30 species of turtles, lizards and snakes for which large series of adults were available. It compares various other parameters with the FMR means, showing that in most instances the mode, median, and means for the 10 largest of each sex (or 5 largest, or 3 largest) approximate the series mean, but the ratio of maximum male and female measurements is more variable. Except where otherwise indicated, by asterisk, the species in Table 1 are those measured by me in field studies of live animals or in studies of museum specimens.

Excluding those 548 taxa for which only maximum measurements for each sex were available, 770 kinds of reptiles

were checked for size difference between the sexes. Twenty-five had males and females of approximately the same size, 371 had females averaging larger than males, and 374 had males averaging larger than females. For the whole group average female size was 104% of male size (66%-248%).

## Ontogenetic change

Sexual size differences are discussed throughout most of this paper as if they were constant and species-specific. Ontogenetic changes have been shown for a few kinds, but figures are less refined than could be desired. Although some studies were based on large-scale marking of individuals, the survivors in the older age groups were generally so few that their means were subject to fairly wide margins of error.

The usual trend seems to be growth at comparable rates in juveniles of both sexes, with divergence in size at adolescence, and little change in SSD during the period of slowing growth after average adult size is attained. Table 2 shows male and female sizes (S-V) in successive

Table 1. FMR (= ratio of female length to male length expressed as per cent).

| Species | N | N | $\bar{x}$ (FMR) | mode | median | maximum | 10 largest | 5 largest | 3 largest |
|---|---|---|---|---|---|---|---|---|---|
| *Turtles* | ♂ | ♀ | | | | | | | |
| *Gopherus agassizii** | 59 | 32 | 92 | 89 | 79 | 95 | 90 | 92 | 92 |
| *Pseudemys scripta** | 98 | 48 | 140 | 146 | 125 | 103 | 109 | 107 | 106 |
| *Terrapene ornata* | 78 | 163 | 101 | 100 | 102 | 103 | 103 | 103 | 104 |
| *Lizards* | | | | | | | | | |
| *Ameiva undulata* | 44 | 69 | 85 | 84 | 85 | 92 | 88 | 91 | 92 |
| *Cnemidophorus deppei* | 152 | 260 | 93 | 87 | 88 | 88 | 88 | 88 | 88 |
| *Cnemidophorus sexlineatus* | 88 | 96 | 101 | 101 | 100 | 102 | 102 | 103 | 102 |
| *Cnemidophorus tigris* | 46 | 75 | 93 | 95 | 96 | 89 | 93 | 90 | 89 |
| *Eumeces fasciatus* | 120 | 180 | 99 | 100 | 100 | 96 | 98 | 98 | 98 |
| *Eumeces obsoletus* | 146 | 128 | 102 | 102 | 104 | 106 | 104 | 104 | 105 |
| *Ophisaurus attenuatus* | 733 | 420 | 95 | 95 | 96 | 92 | 92 | 92 | 91 |
| *Sphenomorphus cherriei* | 39 | 61 | 100 | 102 | 101 | 109 | 103 | 106 | 109 |
| *Snakes* | | | | | | | | | |
| *Agkistrodon contortrix* | 116 | 98 | 93 | 94 | 95 | 76 | 85 | 80 | 77 |
| *Bothrops atrox* | 59 | 53 | 115 | 111 | 116 | 116 | 122 | 122 | 119 |
| *Carphophis vermis* | 90 | 73 | 117 | 116 | 114 | 113 | 119 | 116 | 114 |
| *Coluber constrictor* | 181 | 177 | 110 | 109 | 107 | 109 | 117 | 117 | 116 |
| *Diadophis punctatus* | 906 | 408 | 111 | 114 | 117 | 126 | 119 | 123 | 123 |
| *Dipsas catesbyi* | 99 | 105 | 96 | 101 | 101 | 109 | 126 | 105 | 108 |
| *Elaphe obsoleta* | 255 | 168 | 98 | 94 | 103 | 87 | 88 | 89 | 89 |
| *Lampropeltis calligaster* | 78 | 75 | 91 | 93 | 91 | 90 | 88 | 89 | 90 |
| *Lampropeltis triangulum* | 47 | 35 | 97 | 99 | 97 | 85 | 93 | 92 | 91 |
| *Leptodeira annulata* | 45 | 51 | 108 | 103 | 107 | 110 | 108 | 108 | 109 |
| *Liophis miliaris** | 123 | 244 | 124 | 123 | 130 | 134 | 141 | 139 | 139 |
| *Micrurus fulvius** | 46 | 92 | 119 | 122 | 116 | 158 | 142 | 144 | 158 |
| *Nerodia sipedon* | 55 | 46 | 132 | 134 | 134 | 137 | 138 | 137 | 134 |
| *Pituophis melanoleucus* | 59 | 55 | 101 | 104 | 104 | 91 | 100 | 99 | 96 |
| *Sonora episcopa** | 347 | 302 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| *Thamnophis ordinoides* | 21 | 28 | 123 | 124 | 124 | 130 | 128 | 128 | 128 |
| *Thamnophis sirtalis* | 215 | 282 | 123 | 125 | 160 | 182 | 177 | 180 | 180 |
| *Tropidoclonion lineatum** | 137 | 175 | 117 | 115 | 132 | 131 | 130 | 124 | 129 |
| *Virginia striatula** | 90 | 55 | 116 | 119 | 123 | 119 | 123 | 127 | 117 |

* Clark, 1964, for *Virginia striatula;* Force, 1936, for *Tropidoclonion lineatum;* Gans, 1964, for *Liophis miliaris;* Kassing, 1961, for *Sonora episcopa;* Moll and Legler, 1971, for *Pseudemys scripta;* Quinn, 1979, for *Micrurus fulvius;* Woodbury and Hardy, 1948, for *Gopherus agassizii.*

annual age classes of seven reptile species including one lizard and six kinds of snakes.

In the account of *Alligator mississippiensis* based on a large scale field study by Chabreck and Joanen (1979), it is shown that juvenile males grow faster than females, and although there is some slowing of growth at adolescence, adult males continue to grow faster than adult females. Hence, in the oldest alligators SSD is extreme.

Ernst (1977) presented figures on the sizes of adult *Clemmys muhlenbergii* of different ages that seemed to indicate little change in the size ratio of the sexes as the turtles grew older. In series that were 6, 7, 8, 9, 10 and 11 years of age the female-to-male size ratios were, respectively, 93, 92, 93, 93, 94 and 93 per cent. Both sexes increased in size by 31% from the 6- to 11-year-old class. There were 10 to 17 turtles of each sex in each year class, except 11-year-olds with 4 males and 7 females.

In the large Neotropical iguanid, *Basiliscus basiliscus,* both sexes grow at approximately the same rate for nearly a year, to about 2.5 times hatchling size of 42 mm (S-V). Thereafter, approaching adolescence, the females grow more slowly than males. In the oldest basilisks (6+ years) female to male ratio has decreased to about 72% (♂ 229 mm, ♀ 165) but SSD is less in some localities (Van Devender, 1978).

## Geographic variation

Polytypic species have shown geographic change in the size ratio of the sexes in every case tested, and it may be speculated that such change is the rule. Several examples are presented in Tables 3 to 5. *Uta stansburiana,* being abundant and widespread, provides one of the best examples, and the data for 19 local populations are compared in Table 3. The first 10 populations are from the western United States and Mexico from 45° N in Oregon to 28°20′ N in west-central Sonora, and FMRs range from 87.5 to 100.1. There is not a clear-cut latitudinal gradient, but in all six of the more northern populations (north of latitude 35°) FMR exceeds 93 ($\bar{x} = 95.7$) whereas in the four more southern populations FMR is consistently less than 93 ($\bar{x} = 90.0$). Nussbaum and Diller (1976), who studied the northernmost population in north-central Oregon, found that male aggression was little developed, compared with that of more southern populations. The nine populations represented in the lower half of Table 3 are from various islands in the Gulf of California. Their sexual size dimorphism is comparable to that of mainland populations. Both in having males relatively large in insular populations and in having males relatively larger in southern than in northern populations, *Uta stansburiana* follows trends that are widespread in lizards.

*Cnemidophorus tigris* is another wide-ranging, polytypic lizard species and samples from the northern and southwestern parts of the range showed the sexes to be approximately equal in size with males averaging slightly larger. However, in samples from the southeastern part of the range, south-central New Mexico (Medica, 1967) and Reeves County, Texas (Fitch, 1970) males averaged markedly larger than females (FMRs 87 and 94).

Table 5 shows sexual size differences in geographic populations of *Chrysemys picta.* This wide-ranging species is typical of many freshwater turtles in having females much larger than males, the latter maturing at relatively small size and early age. In this table, for each population, the length (plastral) shown is the minimum at sexual maturity, rather than the adult average, as in most other instances. Although no well defined gradient is discernible, there seems to be a general trend toward having relatively much larger females in the southern half of the United States than in the northern half. Extreme size differences in the sexes results from early sexual

TABLE 2. Ontogenetic Changes in Sexual Size Ratios in Lizards and Snakes: Male and Female Lengths (S-V in Millimeters) and FMRs.

| Species | Second | Third | Fourth | Fifth | Sixth | Seventh | Eighth | Authority |
|---|---|---|---|---|---|---|---|---|
| *Agkistrodon contortrix* | 474*/468 99 | 564/537* 95 | 637/591 94 | 672/609 90 | 702/620 88 | — | — | Fitch, 1960 |
| *Amphibolurus maculosus* | 64*/59* 92.3 | 67/61 91 | 70/62 88.5 | — | — | — | — | Mitchell, 1973 |
| *Coluber constrictor* | 615*/644* 105 | 706/810 114 | 757/866 115 | 810/923 115 | 827/965 117 | 845/974 115 | — | Fitch, 1963 |
| *Diadophis punctatus* | 180*/191 106 | 224/240* 107 | 240/264 110 | 249/277 111 | 256/284 111 | 261/290 111 | 266/298 112 | Fitch, 1975 |
| *Elaphe quadrivirgata* | 796/703 92 | 1038*/954* 92 | 1235/1040 83.2 | 1425/1140 80.2 | — | — | — | Fukada, 1965 |
| *Rhabdophis tigrina* | 678*/731* 108 | 765/878 114.9 | 840/1010 120 | — | — | — | — | Fukada, 1964 |
| *Thamnophis sirtalis* | 455*/550* 121 | 515/625 121 | 550/690 125 | 585/735 126 | 615/775 126 | — | — | Fitch, 1965 |

* Sexual maturity

maturity in males—at a minimum age of only two years whereas females require at least four years. In more northern regions male maturity is delayed until somewhat larger size is attained, at four or five years, and female maturity requires six to ten years.

Iverson (ms) studied SSD in the Mexican mud turtle, *Kinosternum hirtipes*. In a sample of 306 adult males and 237 adult females FMR was 92.3. However, the species has many discrete populations isolated from each other in separate drainage basins and differing in various

TABLE 3. Geographic Variation in Sexual Size Ratios in *Uta stansburiana*.

| FMR (Female to male length ratio per cent) | S-V ♂ | N | S-V ♀ | N | Geographic origin | Authority |
|---|---|---|---|---|---|---|
| 93.9 | 48.4 | | 45.4 | | North Central Ore. | Nussbaum and Diller, 1976 |
| 95.0 | 47.55 | ( 47) | 45.04 | ( 25) | Hart Mtn. Antelope Refuge, Ore., 42°25′ | Parker & Pianka, 1975 |
| 100.1 | 48.56 | (107) | 48.72 | (104) | 3-4 km W Grantville, Utah, 40°36′ | Parker & Pianka, 1975 |
| 96.5 | 48.26 | ( 27) | 46.53 | ( 36) | 8 km N Lovelock, Nev. 40°12′ | Parker & Pianka, 1975 |
| 93.5 | 48.22 | ( 18) | 45.15 | ( 26) | Kyle Canyon, Nev. 36°15′ | Parker & Pianka, 1975 |
| 95.6 | 51.85 | ( 55) | 49.56 | ( 69) | 8 km N Mojave, Calif. 35°06′ | Parker & Pianka, 1975 |
| 91.5 | 51.71 | (102) | 47.38 | (114) | S Mtn, Phoenix, Ariz. 33°26′ | Parker & Pianka, 1975 |
| 92.4 | 55.34 | (101) | 51.11 | ( 91) | 16 km NW Casa Grande, Ariz. 32°57′ | Parker & Pianka, 1975 |
| 88.6 | 50.39 | ( 18) | 47.44 | ( 16) | Dona Ana and Luna Cos, NM 31°50′ | Parker & Pianka, 1975 |
| 87.5 | 53.29 | ( 17) | 47.05 | ( 21) | 7 km E Estero de Tastiota, Sonora 28°20′ | Parker & Pianka, 1975 |
| 94.0 | 44.59 | ( 32) | 41.83 | ( 24) | Isla San Francisco | Dunham & Tinkle, 1978 |
| 91.0 | 50.88 | ( 16) | 46.28 | ( 25) | Isla San José | Dunham & Tinkle, 1978 |
| 88.6 | 45.95 | ( 20) | 40.67 | ( 18) | Isla Partida Sur | Dunham & Tinkle, 1978 |
| 91.1 | 44.88 | ( 17) | 40.89 | ( 18) | Isla San Marcos | Dunham & Tinkle, 1978 |
| 91.1 | 51.50 | ( 34) | 46.85 | ( 34) | Isla Carmen | Dunham & Tinkle, 1978 |
| 93.1 | 49.56 | ( 25) | 46.04 | ( 26) | Isla Tortuga | Dunham & Tinkle, 1978 |
| 91.5 | 48.50 | ( 18) | 44.39 | ( 26) | Isla Tiburon | Dunham & Tinkle, 1978 |
| 92.2 | 52.48 | ( 27) | 48.36 | ( 47) | Isla Partida Norte | Dunham & Tinkle, 1978 |
| 94.4 | 47.21 | ( 39) | 44.60 | ( 30) | Isla San Esteban | Dunham & Tinkle, 1978 |

TABLE 4. Geographic Variation in Sexual Size Ratios in *Cnemidophorus tigris*.

| FMR ♀ to ♂ ratio, percentage S-V | ♂ S-V range N | ♀ S-V range N | Region | Authority |
|---|---|---|---|---|
| 99.8 | 94.8 (93-97 in 10) | 94.6(91-102 in 10) | SW Idaho | Burkholder & Walker, 1973 |
| 99.4 | 77.6 (97-66 in 22) | 77.1(88- 69 in 9) | L. Colorado River | Vitt & Ohmart, 1977b |
| 97.7 | 85.6 (79-95 in 52) | 83.7(71- 98 in 43) | Test Site, S Nevada | Tanner & Banta, 1966 |
| 93.6 | 83.5 (79-95 in 44) | 78.1(71- 87 in 79) | Reeves Co., Texas | Fitch, 1970 |
| 87.1 | 82.24(64-97) | 71.6(54- 88) | S-Central New Mex. | Medica, 1967 |

TABLE 5. Relative Lengths of Males and Females of *Chrysemys picta* at Sexual Maturity.

| FMR | Male at sexual maturity length | Male age (yrs.) | Female at sexual maturity length | Female age (yrs.) | Region (state in USA) | Authority |
|---|---|---|---|---|---|---|
| 175 | 70 | | 120–125 | | S. Ill. | Cagle, 1954 |
| 175 | 60–65 | 2–3 | 100 | 4 | La., Ark. | Moll, 1973 |
| 162 | 65 | 2–3 | 105 | 4–5 | Tenn. | Moll, 1973 |
| 158 | 80–85 | 3–4 | 130 | 4–6 | Cent. Ill. | Moll, 1973 |
| 153 | 80–90 | | 130 | | New Mex. | Christiansen and Moll, 1973 |
| 147 | 85+ | | 125+ | | S. Minn. | Legler, 1954 |
| 144 | 80 | 5 | 110–120 | 7–10 | S. Mich. | Gibbons, 1968 |
| 141 | 95–100 | 4–5 | 135–140 | 7–8 | Wisc. | Christiansen and Moll, 1973 |
| 139 | 90 | | 120–130 | | N. Mich. | Cagle, 1954 |
| 118 | 80–90 | 4 | 100 | 4–6 | Penn. | Ernst, 1971 |
| 117 | 95–100 | 4–5 | 135–140 | 7–8 | S. Mich. | Wilbur, 1975 |

characters including SSD. Drainage basins in Mexico that yielded substantial series, and the FMRs obtained from them were as follows: Papigochic 85.9 (22 males, 23 females), Conchos 86.5 (56 males, 42 females), Nazas 92.0 (20 males, 13 females), Santa Maria 92.3 (39 males, 25 females), Aguanaval 95.8 (28 males, 22 females), Mezquital 100.2 (28 males, 29 females). Seven other populations represented by only small samples had FMRs exceeding 100. Iverson found a trend for the smaller drainages and those containing lakes to have populations of relatively small turtles in which there was little size dimorphism or else female-favored size dimorphism.

In the Neotropical lizard, *Anolis cupreus,* massive samples are available to show geographic variation in sexual size differences over the range. The males are markedly larger. In *A. c. cupreus* and *A. c. spilomelas* of the lowlands of northwestern Costa Rica, FMRs are 88 and 84, respectively, and 82 in *macrophallus* of Guatemala. But in *A. c. hoffmanni* at the upper altitudinal limit, on the Meseta Central of Costa Rica, FMR is 97. The intraspecific trend in *A. cupreus* conforms with interspecific trends in the large genus *Anolis.* Those kinds in severely seasonal climates where cold or drought prevent reproduction over part of the year, with a relatively concentrated and stressful breeding season, have relatively larger males than do kinds living in climates that tend to be aseasonal, such as rain forests and montane cloud forests.

*Ameiva auberi* is a small terrestrial teiid lizard that is widely distributed over the West Indies, with named subspecies on many islands. There is much intraspecific variation in size and also, apparently, in size ratios of the sexes, but figures are available only for maximum sizes of each sex (Schwartz, 1970; McCoy, 1970). Excluding small samples (those in which less than 28 specimens were available) there were 15 population samples from Cuba and neighboring islands, and 7 samples from the Bahamas, with from 28 to 123 specimens. FMRs ranged from 95.7 (*auberi,* N coast of Cuba) to 59.6 (*multilineata,* Berry Islands, Bahamas). For the entire group of 22 populations, FMR averaged 79.3, but it averaged much lower (70.3) for the 7 Bahamian subspecies than for the 15 from Cuba and vicinity (82.6). Despite this regional difference, the subspecies showed no obvious correlation with size of island, body size, or any other obvious factor in the trend of their sexual size difference.

In West Indian anoles presence or absence of congeneric competitors seems to be a major factor affecting SSD.

Schoener (1970) and Schoener and Schoener (1971a, 1971b) have published figures for many populations, in sympatry and allopatry, showing varying degrees of character displacement. For each species I arbitrarily selected one FMR figure when several were available, to include in Appendix I and the annotated list. SSD in anoles is further discussed below in the annotated list.

## Annotated Systematic List

In the following list the various groups of reptiles are treated in the usual systematic sequence. Under each major group, genera and species are listed alphabetically, with a figure or symbol indicating FMR of each species, followed by brief comments on the trends within the group, and possible explanations for them. The groups first tested were families but some were combined into larger systematic units or divided. Data were obtained for relatively few kinds of turtles, hence there is only one list for the order Testudines, but there are many lists for the order Squamata and its main subdivisions, the snakes and lizards. In the large ophidian family, Colubridae, 24 subfamily units are separately listed, because substantial series of species were available in some, with distinctive trends setting them off from other subfamilies. Similarly, the large family Iguanidae is divided into seven subfamily units to treat with the 226 taxa for which definite FMR figures are available. I follow Etheridge (1964, 1965, 1966) in the iguanid subfamilies recognized, except that I have also included "crotaphytines" and "phrynosomines" not formally designated by Etheridge but implied by him in dissociating *Crotaphytus* and *Phrynosoma* from the sceloporine genera. Both are sufficiently distinctive in the trends of their SSD to merit separate treatment.

### Testudines

*Chelonia mydas* 106 m, *Chelydra serpentina* 100 x̄, *Chersina angulata* −−−, **Chrysemys picta 139, Clemmys guttata 100,** *C. marmorata* 100 m, **C. muhlenbergii 107,** *Deirochelys reticularia* 194 m, **Emydoidea blandingii 95,** *Emys orbicularis* 106 m, *Eretmochelys imbricata* 104 m, **Geochelone elephantopus ephippium 82, G. e. vicina 99,** *G. pardalis* +++, *G. p. babcocki* +, *G. radiata* 93 x̄, **Gopherus agassizii 92,** *G. polyphemus* 106 m, *Graptemys barbouri* 195 m, **G. geographica 196,** *G. kohni* 182 m, *G. nigrinoda* 143 m, *G. oculifera* 184 m, **G. ouachitensis 167, G. pseudogeographica 169,** *G. pulchra* 248 m, *Homopus areolatus* ++, *H. boulengeri* X, *H. femoralis* ++, *Kinixys belliana* +, *K. b. nogueyi* X, *K. erosa* −−−, *K. homeana* X, *Kinosternon bauri* 101 x̄, *K. b. palmarum* 121 m, **K. flavescens 98,** *K. subrubrum* 118 m, **K. s. hippocrepis 100,** *Lepidochelys olivacea* +, **Macrochelys lacertina 86,** *Malaclemys terrapin* 158 m, *M. t. centrata* 144 x̄, **M. t. tequesta 141,** *Malacothoerus tornieri* ++, *Psammobates oculifer* +, *P. tentorius* ++++, *P. t. verroxi* ++, *Pseudemys concinna* 117 m, **P. floridana 139,** *P. f.* "*suwanensis*" 143 m, *P. f. texana* +, *P. rubriventris* 116 x̄, **P. scripta 140,** *P. s. troosti* 108 m, *Rhinoclemys annulata* +, *R. areolata* +, *R. funerea* −, *R. nasuta* +, *R. pulcherrima* +, *R. p. incisa* 117 x̄, *R. p. manni* ++, *R. p. rogerbarbouri* +++, *R. punctularia* +, *R. p. diademata* +++, *R. rubida* −−, *R. r. perixantha* +, **Sternotherus carinatus 98, S. minor 105, S. odoratus 105,** *Terrapene carolina* 91 x̄, **T. coahuila 93, T. ornata 102,** *Testudo graeca* 97 m, *T. kleinmanni* +, **Trionyx muticus 158,** *Trionyx spiniferus emoryi* 236 m, **T. s. ferox 168,** *T. s. pallidus* 182 m.

The FMR samples, representing 50 taxa (all cryptodiran) averaged 129.8 ± 5.68. Females were larger in 70%, males in 22% and sexes were equal-sized in 8%.

The most striking aspect of these figures is the relatively large size of females in most species, and especially in those of highly aquatic habits. In those kinds having the males larger, the

difference is usually small, and most such species have terrestrial tendencies. Although precise figures are not available for any pleurodiran, Roze (1964) wrote of the giant South American river turtle *Podocnemis expansa* that adult females averaged about two feet in shell diameter, males about 1½, hence FMR probably approximates 133. Relative large female size is most extreme in the emydid genus *Graptemys*. In *G. pulchra* of Alabama adult male size is 80-120 mm, whereas adult females are 212-285 mm (Shealy, 1976). Males mature in their third or fourth year, but females require about 14 years to mature. In soft-shelled turtles the SSD is almost as great. Plummer (1977) found FMR of 158 in *Trionyx muticus*. Associated with this great size difference there was striking difference in habits and behavior. Males spent more time in basking and tended to keep in shallow water in relatively small home ranges, but in contrast the large females spent their time in deep water in the main channel of the river, with relatively long movements upstream and downstream. Plummer and Farrar (ms) studied food habits of *T. muticus* from the stomach contents of 105 adults of this same population. The diet of males was found to be more diverse than that of females, and significantly different numerically and volumetrically. Approximately 71% of the food volume taken by females consisted of aquatic organisms, of which larvae of the trichopteran *Hydropsyche* were by far the most numerous, whereas approximately 67% of the food volume taken by males consisted of terrestrial items. The most important items for males, in order of decreasing volume, were: mulberries 34.3% (48), cottonwood seeds 15.3% (892), trichopteran larvae 10.4% (456), dipterans 6.3% (139), beetles 4.2% (206), fish 1.7%, lepidopterans 1.2% (9). In contrast, the most important items for females were: trichopteran larvae 43.7% (2430), fish 20.1%, mulberries 16.3% (28), crayfish 4.9% (7), beetles 2.3% (17) and ephemeropteran larvae 1.9% (59). No significant relationship was evident between prey size and turtle size, nor between prey size and sex of turtle.

Males are larger than females in the tortoises *Geochelone* species and *Gopherus agassizii*, the box turtle *Terrapene carolina*, the emydids *Clemmys muhlenbergii* and *Emydoidea blandingii*, the chelydrids, *Chelydra serpentina* and *Macrochelys lacertina*, and the kinosternid, *Kinosternon flavescens*. In all of these and in many other kinds of turtles male aggression is known to occur. Harless (1978) summarized the literature on agonistic behavior in turtles. Eleven accounts pertained to *Terrapene* and 11 others to testudinids *(Chersine, Geochelone, Gopherus)*; 8 were of chelydrids, 8 were of *Clemmys*, 5 were of kinosternids *(Kinosternon, Sternotherus)*, 4 were of cheloniids *(Chelonia, Eretmochelys)*, 2 were of *Chrysemys*, 2 were of *Trionyx* and 1 was of *Graptemys*.

Male combat is prominent in some species in which the sexes are nearly the same size, or in which the female is a little larger. In *Chelonia mydas* Booth and Peters (1972) described attacks on the mating male by "attendant" males.

In captive turtle groups, including tortoises, box turtles, and *Clemmys insculpta*, males are known to form dominance hierarchies. Agonistic behavior consists of biting and ramming. Threatening posture, rapid approach, hissing, and odors including those of the feces, reinforce dominance. Dominant males may inhibit the feeding and mating activities of other males. Under natural conditions turtles are not known to have polygynous mating systems, and males rarely, if ever, maintain discrete territories.

It should be noted that much different FMRs have been obtained for the same species of turtles in a few instances when two or more authors have published different sets of figures. For instance, for *Chelydra serpentina* an FMR of approximately 100 is indicated both

from White and Murphy's (1973) plastral measurements and Christiansen and Burken's (1979) carapace measurements, whereas Mossiman and Bider's (1960) carapace measurements of a Quebec population indicate FMR of 88. For *Kinosternum subrubrum* Mahmoud's (1967) figures indicate FMR of 100 whereas Iverson's (1979a) indicate FMR of 118. It needs to be determined how much such differences actually reflect geographic or ontogenetic variation vs. authors' biases in collecting, or in their criteria for setting the lower limits of adults of each sex.

## Squamata: Sauria

**GECKONIDAE.** *Aristelliger georgeensis* ——, *A. hechti* ——, *A. lar* ——, *A. praesignis* ——, **Coleodactylus amazonicus 105,** *Coleonyx brevis* X, *C. elegans* X, *C. mitratus* X, **C. variegatus 107, C. v. utahensis 114, Cosymbotus platurus 99, Cyrtodactylus malayanus 109, C. pubisculus 110,** *Eublepharus angramainyu* 89 x̄, *Garthia dorbignyi* X, *G. penai* X, *Gecko japonicus* ———, *G. vittatus* X, *Gehyra australis* 104 x̄, **G. oceanica 97,** *G. variegata* 99 x̄, **Gonatodes albogularis 100,** *G. annularis* 101 x̄, *G. concinnatus* 99 x̄, *G. humeralis* 106 m, **Hemidactylus frenatus 96,** *H. mabouia* 106 m, **H. turcicus 106, Heteronotia binoei 108,** *Lepidodactylus lugubris* 102 x̄, *Lygodactylus angolensis* X, *L. capensis* X, *L. picturatus* —, *Pachydactylus punctatus* +, *P. tuberculosus* —, *Palmatogecko rangei* ++, **Peropus mutilatus 99,** *Phelsuma laticauda* ——, *P. lineata* ——, *P. madagascarensis* —, **Phyllodactylus angustidigitatis 95,** *P. europaeus* 98 x̄, **P. gerrhopygus 98, P. inaequalis 100, P. interandinus 105, P. johnwrighti 103, P. kofordi 102, P. lepidopygus 115, P. microphyllus 100, P. reissi 97,** *P. tuberculosus* 102 m, **P. ventralis 100,** *Pseudogonatodes guianensis* 102 x̄, *Ptenopus garrulus* 101 x̄, **Sphaerodactylus argivus 99, S. argus 113, S. a. bartschi 106,** *S. cinereus* X, *S. copei astreptus* X, *S. c. pelates* X, *S. c. websteri* X, **S. lewisi 108, S. oxyrhinus 111, S. o. dacnicolor 102,** *S. rosaurae* X, **S. semasiops 110,** *Tarentola americana* —, **T. mauritanica 84,** *Thecadactylus rapicaudus* 106 x̄.

Among 43 species of geckos tested, FMR ranged from 84 to 115, and averaged 101.9. Males were larger in 13 species; females were larger in 26, and the sexes were equal in four. Eleven of these geckos were members of the large genus *Phyllodactylus* and in all but one of these males and females averaged nearly equal in size. The exception was *P. lepidopygus* having a FMR of 115. The remaining 32 species of geckos were in 15 genera representing Europe, Africa, Asia, Australia and South and Central America. The species having relatively largest males, *Tarentola mauritanica* (FMR 84) and *Eublepharis angramainyu* (FMR 89) are from the temperate-zone climate of Spain and Iran, whereas most of those with relatively large females were from equatorial regions.

Geckos are known to maintain territories, with visual cues and vocalizations playing important roles. Males are more aggressive, and in some instances there is dimorphism, with males more conspicuously marked. Large males would seem to have a selective advantage in defending territories and securing mates. Especially where there is a relatively short and concentrated, and therefore stressful breeding season, large size might confer selective advantage. Oviparity is the rule (except in New Zealand) with a two-egg clutch (or one egg, in sphaerodactylines and a few small geckonines). The hatchlings are relatively large. Large hatchlings probably have better chances of survival than small ones. Doubtless there is selective pressure for females to produce larger young, counteracted by selection for light weight, in these small scansorial lizards dependent on their digital lamellae to cling to surfaces that are sometimes smooth and vertical.

**IGUANIDAE.** This is a large and diverse family of lizards, mostly of the Western Hemisphere. They range from

small to large. They are vision-oriented, and there are usually special display organs in the males, less developed or lacking in the females. The displays are stereotyped and species-typical, and serve both in territorial aggression and defense and in courtship. Most iguanids are oviparous but several genera of basiliscines, sceloporines, phrynosomines and tropidurines have some viviparous species. Average clutch size ranges from just one in anolines to several dozen in large mainland iguanines.

ANOLINAE. **Anolis aeneus 71,** *A. ahli* ———, **A. allisoni 74, A. allogus 75,** *A. alumina* —, **A. alutaceus 92, A. angusticeps 88,** *A. aquaticus* 89 x̄, **A. argillaceus 81, A. attenuatus 95,** *A. auratus* 104 x̄, **A. a. sipaliwinensis 104,** *A. baleatus* ——, *A. b. litorisilva* ——, *A. b. multistruppus* —, *A. b. scelestus* ——, *A. bahorucoensis southerlandi* ——, *A. barahonae* —, *A. barkeri* ——, **A. bimaculatus 71, A. biporcatus 102, A. biscutiger 106,** *A. bombiceps* 110 m, **A. bourgaei 103,** *A. bremeri* 70 x̄, **A. brevirostris 89, A. capito 106, A. carolinensis 79,** *A. carpenteri* 105 x̄, **A. chlorocyaneus 76, A. christophei 92, A. chrysolepis 105, A. coelestinus 78, A. concolor 74, A. cooki 70,** *A. crassulus* 88 x̄, **A. cristatellus 79, A. cupreus 88, A. c. hoffmanni 97, A. c. macrophallus 82, A. c. spilomelas 84, A. cuprinus 73, A. cuvieri 92, A. cybotes 77,** *A. damulus* 110 x̄, **A. distichus 87,** *A. d. biminiensis* 90 x̄, *A. dolichocephalus sarmenticola* ——, *A. d. portusalus* ——, **A. dollfusianus 94, A. equestris 93, A. evermanni 74,** *A. extremus* ——, **A. frenatus 82, A. fuscoauratus 108,** *A. f. kugleri* 102 x̄, **A. gadovii 89, A. garmani 75, A. gemmosus 94, A. grahami 68, A. g. aquarum 73, A. gundlachi 69, A. hendersoni 84,** *A. h. ravidormitans* —, *A. heteropholidotus* 109 x̄, **A. homolechis 78,** *A. h. cuneus* ———, *A. h. jubar* ———, *A. h. oriens* ———, *A. h. quadriocellifer* ———, **A. humilis 105, A. intermedius 99,** *A. isthmicus* 89 x̄, **A. kemptoni 104, A. krugi 79, A. lemurinus 104, A. limifrons 103** (Costa Rica), **A. limifrons 99** (Pan.), **A. lineatopus 69, A. lionotus 85,** *A. lividus* ——, *A. loysiana* 89 x̄, *A. luciae* ———, **A. lucius 84, A. megapholidotus 98,** *A. mestrei* ———, *A. monticola* ———, **A. nebulosus 100, A. nigrolineatus 94,** *A. nubilus* ———, **A. occultus 100,** *A. oculatus* ———, *A. o. cabritensis* ——, *A. o. montanus* ———, *A. o. winstoni* ——, **A. olssoni 91, A. opalinus 82,** *A. ortoni* 96 x̄, **A. pachypus 101,** *A. pentaprion* 81 x̄, *A. peraccae* 93 x̄, *A. petersi* +, **A. pinchoti 90,** *A. poecilopus* 96 x̄, **A. polylepis 93, A. poncensis 87, A. porcatus 72, A. pulchellus 80,** *A. punctatus* 88 x̄, *A. p. boulengeri* 103 m, **A. quercorum 89,** *A. quadriocellifer* ———, **A. richardi 81,** *A. ricordi subsolans* X, *A. r. viculus* —, **A. rodriguezi 101, A. roquet 77,** *A. rubribarbis* ———, *A. rupinae* ———, *A. sabanus* ——, **A. sagrei 73, A. s. stejnegeri 79, A. semilineatus 86, A. sericeus 90,** *A. smaragdinus* 78 x̄, **A. subocularis 76,** *A. stratulus* 86 x̄, **A. taylori 79, A. trachyderma 115, A. tropidogaster 96, A. tropidolepis 99, A. tropidonotus 81, A. uniformis 98, A. valencienni 86, A. villai 89,** *A. vittigerus* 125 x̄, **A. wattsi 87,** *A. woodi* 87 x̄, **Chamaeleolis chamaeleonides 99,** *Enyalioides laticeps* 108 m, *Enyalius bilineatus* ++, *E. boulengeri* +, *E. catenatus* X, *E. iheringii* ++, *Polychrus marmoratus* 124 x̄, *Urostrophus ornatus* X.

Because the lizards of the genus *Anolis* are numerous in species and often extremely abundant, much information has accumulated concerning their sexual size relationships. Schoener (1967) noted that in *Anolis conspersus*, isolated from other species on Grand Cayman Island of the West Indies, males are much larger than females, and are able to take larger prey items of different kinds, with the result that there is partial partitioning of food resources between the sexes, and the potential carrying capacity of the habitat is increased. Later, Schoener (1970) discerned consistent patterns in the size relationships of insular West Indian species of *Anolis* of which there are several score. He found that wher-

ever a small island is inhabited by a single species, that species is small-sized (often 40-70 mm snout-vent), with males much larger than females. Thus the relationships found in *A. conspersus* were repeated in many other species. On islands that had two or more species, character displacement in size occurred to varying degrees. Depending on the extent of habitat overlap, species occurring in sympatry were altered from their size relationships in allopatric situations, becoming less similar, with SSD reduced so that size overlap with competing species was minimized. Schoener found that in solitary kinds, the males collectively are larger than the males on the island having the richest anole faunas. With increasing species diversity, the species size distribution of males irregularly decreases in median, but increases in range of skewness. He found greater SSD in larger species.

In a later study of mainland anoles I found (Fitch, 1976) correlation between climate and SSD; species living in relatively aseasonal climates of tropical rain forests or cloud forests tended to have the sexes nearly equal in size, or else the females were larger, but species living in sharply seasonal climates with drought or cold limiting reproduction to a concentrated short and stressful breeding season had males much larger than females (Table 6).

In *Anolis* species, SSD has a range nearly as wide as that in all other lizards combined, with FMR from a minimum of 68 in *A. grahami* to 125 in *A. vittigerus*. Males are consistently larger than females in the insular species (mean FMR 81) whereas in about 40% of the mainland species females are larger (mean FMR 96). For 106 anole taxa FMR averages 89. It is noteworthy that no rainforest species of the mainland have males much larger than females. Similarly, in the giant rainforest anolines *Enyalioides, Enyalius, Polychrus,* and *Urostrophus,* females are relatively large.

TABLE 6. Mean Female to Male Ratios (FMR) in *Anolis*.

| Species grouping | Number of taxa | Mean FMR | $\sigma^{m}$ | Range |
|---|---|---|---|---|
| All species tested | 106 | 89.21 | ±1.17 | (68-125) |
| Insular species | 48 | 80.90 | ±1.15 | (68-100) |
| Mainland species (all) | 58 | 96.09 | ±1.35 | (73-125) |
| Humid tropical lowlands | 29 | 100.41 | ±1.78 | (81-125) |
| Montane | 15 | 97.27 | ±1.84 | (87-110) |
| Xeric | 12 | 85.00 | ±2.12 | (73-100) |

BASILISCINAE. **Basiliscus basiliscus 78, B. vittatus 86,** ***Corythophanes cristatus*** **109** $\bar{x}$.

In these amphibious and arboreal iguanids, SSD is large, and is accompanied by marked dimorphism, with dorsal crests developed in the male. Territoriality is highly developed in basilisks and males fight fiercely at times. In a study of Costa Rican populations of *B. basiliscus*, Van Devender (1978) found that SSD differed greatly, sometimes even between the populations of neighboring stream courses, and was highly responsive to such environmental factors as population density, and food supply.

CROTAPHYTINES. **Crotaphytus collaris 93, Gambelia wislizenii 115.** *C. collaris* is a fairly typical iguanid, having the male markedly larger than the female, territorial with bright colors and conspicuous display, whereas *G. wislizenii* is highly atypical, having the female much larger than the male, and the male lacking territoriality and display. *G. wislizenii* is nomadic, and a lizard may wander widely rather than remaining in a small and relatively permanent home range or territory such as found in most iguanids. Wandering tendencies are probably correlated with predatory habits; in addition to insects, leopard lizards regularly prey upon smaller lizards such as *Uta, Sceloporus, Phrynosoma* and *Holbrookia*. The large females are more saurophagous than the males. The allopatric *G. silus* of the San Joaquin Valley

in California differs from *G. wislizenii* in being largely insectivorous, in being territorial, and in having relatively large males.

IGUANINAE. **Amblyrhynchus cristatus 85,** *Conolophus subcristatus* 91 x̄, **Ctenosaura similis 80, Cyclura carinata 82, C. cornuta 92, C. cychlura 93, C. pinguis 86, Dipsosaurus dorsalis 95, Enyaliosaurus clarki 93, Iguana iguana 91, Sauromalus obesus 92.**

These mostly large to giant-sized, mainly herbivorous and mainly tropical iguanids all have males larger than females. Several of them have been subjects of intensive ecological and behavioral studies, which have indicated the following characteristics: there is a short and concentrated annual breeding season; males are highly territorial, but many are subordinates that are denied territories because they cannot compete with the dominant adults. Subordinate males are often adolescents or small adults that have not yet attained their prime. Reproductive females may be crowded together in harems, or may be spaced because of mutual intolerance much weaker than that prevailing among the males. The latter fight fiercely at times, but most often rely on their stereotyped displays to threaten or discourage potential rivals.

PHRYNOSOMINES. **Phrynosoma cornutum 107,** *P. coronatum* 102 X, **P. douglassi 110,** *P. modestum* 112 x̄, *P. orbiculare* 103 x̄, **P. platyrhinos 106, P. solare 108.**

The horned lizards are aberrant iguanids. Males lack bright colors and special display organs. Territoriality seems to be lacking and display is weakly developed. Whitford and Whitford (1973) found that individuals of *P. cornutum* often moved more than 100 meters in a day and frequently approached within one meter of another individual. Ordinarily when such lizards became aware of each other, there was head bobbing and mutual retreat. In an exceptional instance observed on 19 July 1972, one lizard charged another that had approached, bit it, and secured a hold, and the two fought intermittently for an hour and 10 minutes until they were separated by the observer. Fighting consisted of biting, scratching, and thrusting movements of the head by which the opponent was jabbed with the occipital horns. Presumably the combatants were males, but their sex was not determined. Despite this isolated observation, it seems clear that display and combat behavior are relatively weak in *Phrynosoma* compared with those in most other iguanids. The horned lizards are largely myrmecophagous. They are relatively slow-moving and rely on their cryptic patterns and to a lesser extent on their spines for protection. Most of the species, including *cornutum, coronatum, modestum, platyrhinos,* and *solare* are oviparous, but *douglassi* and *orbiculare* are live-bearers. Broods in both the egg-laying and live-bearing species tend to be large compared with those of other iguanids of similar size. It is noteworthy that in all seven species investigated, females are larger than males, thus deviating from the usual trend in iguanids.

SCELOPORINAE. **Callisaurus draconoides 89, C. d. rhodostictus 90, Holbrookia maculata 108,** *H. m. approximans* 93 x̄, **Sceloporus adleri 92, S. bulleri 97, S. chrysostictus 95, S. clarki 92, S. c. boulengeri 81, S. cozumelae 87,** *S. cyanogenys* 105 x̄, *S. formosus* 103 x̄, **S. graciosus 104, S. g. "gracilis" 103, S. g. vandenburgianus 95, S. grammicus 96, S. insignis 92, S. jarrovi 91,** *S. lundelli* 105 x̄, **S. magister 84, S. malachiticus 95, S. megalepidurus 99, S. merriami 95, S. m. annulatus 95, S. mucronatus 95, S. nelsoni 87, S. occidentalis 106, S. o. biseriatus 107, S. olivaceus 111, S. orcutti 90,** *S. pictus* 98 x̄, **S. poinsetti 86,** *S. pyrocephalus* 85 x̄, **S. scalaris 111, S. s. aeneus 99, S. s. bicanthalis 106, S. siniferus 86, S. smaragdinus 93, S. spinosus 99, S. taeniocnemis 97, S. teapensis 93,** *S. torquatus* 99 x̄, **S. undulatus 110, S. u. consobrinus 101, S. u. elongatus 112, S. u.**

**erythrocheilus 110, S. u. garmani 107, S. u. hyacinthinus 107, S. u. tristichus 107,** *S. utiformis* 93 x̄, **S. variabilis 81, S. virgatus 112, S. woodi 106, Uma inornata 79, U. notata 79, U. scoparia 86, Urosaurus ornata 97, Uta antigua 92, U. mearnsi 96, U. nolascensis 93, U. palmeri 91, U. squamata 93, U. stansburiana 87.**

This is a large group of xeric adapted, mostly ground living (or scansorial), medium- to small-sized iguanids that are best represented in southwestern North America. Males are usually larger than females, but there are many exceptions, especially in the large genus *Sceloporus*. In most there is strongly developed sexual dichromatism with males having bright colors that function in aggressive displays. These colors are most often concentrated on the sides of the ventral surface, where they are concealed when the animal is at rest, flattened against the substrate. In some species display colors and behavior are largely lacking, and males do not maintain territories. In an earlier report (Fitch, 1978) I have discussed SSD in the genus *Sceloporus*. Those kinds having relatively large females were found to be characterized by a relatively large brood, single annual brood, small body size (< 60 mm S-V) and range in the Temperate Zone more often than by the opposite conditions. With few exceptions, most kinds of *Sceloporus* having females larger than males occur in the United States, north of latitude 30°, whereas most kinds having males larger occur south of latitude 30° in southern Texas, Mexico or Central America.

TROPIDURINAE. *Ctenoblepharis nigriceps* ––, **Leiocephalus astictus 85,** *L. barhonensis* ––, *L. b. aureus* ––, *L. b. beatanus* ––, *L. b. oxygaster* –––, **L. cubensis 77, L. exotheotus 84, L. gigas 72,** *L. lunatus* ––, *L. l. arenicolor* ––, *L. l. melaenacelis* X, *L. l. thomasi* ––, *L. macropus felinoi* 70 m, *L. pambasileus* 78 x̄, *L. paraphrus* 76 x̄, *L. personatus* ––, *L. p. actitis* –––, *L. p. agraulus* ––, *L. p. budeni* ––, *L. p. mentalis* ––, *L. p. scalaris* ––, *L. p. tarachodes* ––, *L. p. trujilloensis* ––, *L. raviceps klinkowskii* 89 x̄, **L. r. uzzelli 82, L. sierrae 66, L. stictigaster 83,** *L. vinculum* –, *L. v. altavelenius* –, *Liolaemus anomalus* 91 x̄, **L. archeforus 91,** *L. a. sarmentiori* 94 m, *L. constanzae* –, *L. fuscus* –, **L. kingii 92,** *L. lemniscatus* –, *L. magellanicus* X, *L. monticola* X, *L. nigroviridis* –, *L. pictus* X, *L. platei* ––, *L. tenuis* X, *Plica plica* X, *Plica umbra* 91 m, *P. u. ochrocollaris* 97 m, *Strobilurus torquatus* +, **Tropidurus albemarlensis 79, T. a. barringtonensis 84, T. bivittatus 78, T. delanonis 76, T. duncanensis 89, T. grayi 116, T. habeli 79, T. icae 87, T. occipitalis 81, T. pacificus 87, T. peruvianus 86, T. salinicola 92, T. stolzmanni 71, T. talarae 78,** *T. theresiae* X, **T. thoracicus 87,** *T. torquatus* 80 x̄, *Uracentron azureum* X, *U. a. guentheri* X, *U. a. werneri* X, *U. flaviceps* 70 x̄, *Uranoscodon superciliosa* X.

In this South American and West Indian subfamily males tend to be much larger than females (Fig. 1), and have display coloration and behavior well developed in connection with territoriality and courtship. An unexplained exception to this trend is *Tropidurus grayi* of Charles Island in the Galapagos, having females larger.

**AGAMIDAE.** *Agama agama* 86 m, **A. agilis 87,** *A. atra* ––, *A. atricollis* 89 x̄, *A. cyanogaster* ––, *A. hispida* 95 x̄, *A. h. aculeata* –, *A. kirki* –, *A. mossambica* –––, **A. pallida 109,** *A. planiceps* –, **A. tuberculata 93, Amphibolurus maculosus 91,** *Calotes versicolor* –, **Draco melanopogon 106, D. quinquefasciatus 102,** *Goniocephalus modestus* –, **Japalura swinhonis 95,** *Leiolepis belliana* –, **Moloch horridus 113,** *Phrynocephalus ornatus* X, *P. scutellatus* 105 m, *Physignathus concinnus* ––, *Salea anamallayana* ––, *S. horsfieldi* ––.

The agamids are active, diurnal, visually oriented lizards of Africa, Asia and Australia. Nearly all are oviparous. Various ecological studies of agamid species (Harris 1964, Mitchell 1973, Waltner

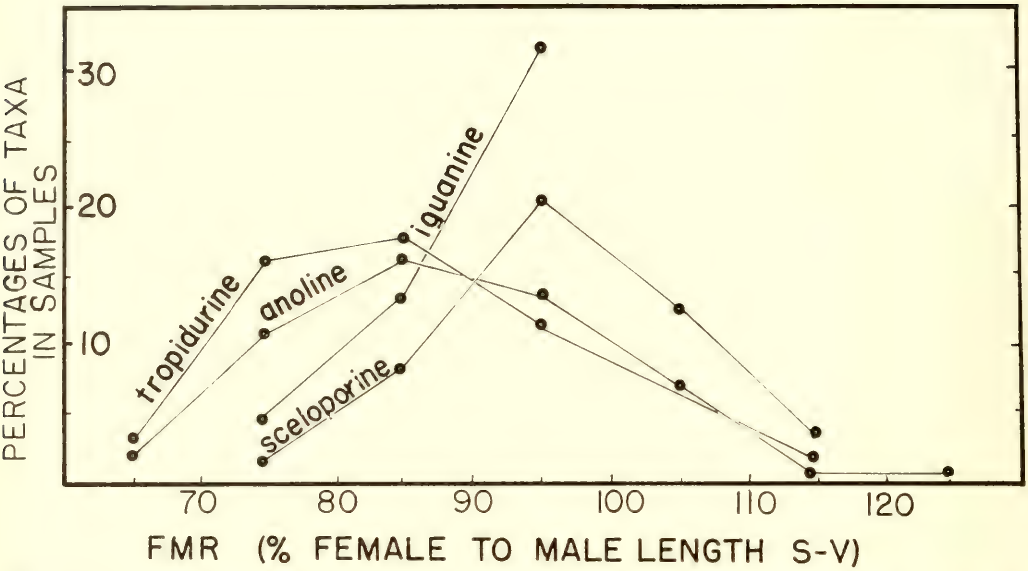


FIG. 1. Comparison of FMR in subfamilies of iguanid lizards; tropidurines and anolines especially tend to have relatively large males.

1978) have demonstrated that most agamids are highly territorial, with sexual dimorphism and special display organs in the male. Mitchell (1973) described the mating system in *Amphibolurus maculosus* in which only certain large and dominant males develop bright colors and maintain territories; others remain dull colored and passive and spend relatively little time above ground. Waltner (1978) observed male display and fighting in *Agama tuberculata.* He found FMR slightly lower (92.7) in a population at low altitude (having a relatively long active season and probably producing two clutches) than at medium altitude in the Himalayas where the season of activity was relatively short with only one clutch per year. Smith (1935) described male display and fighting in flying lizards *(Draco).* The males have distensible dewlaps and also have lateral patagia supported by the elongate ribs, used as wings to support the animals' weight in gliding but also having bright colors used in display. These lizards are often found in pairs and it has been suggested that they are monogamous but perhaps the associations are temporary, as in many kinds of iguanids. The clutch in *Draco* is usually only two to four eggs. The Australian myrmecophagous desert agamid, *Moloch horridus* has relatively large females (FMR 113). It is solitary, non-territorial, nomadic, and slow-moving, relying on its spines and cryptic coloration for protection. It produces relatively large clutches (Pianka and Pianka, 1970). In all these traits it is remarkably convergent with the North American iguanid horned lizards *(Phrynosoma).*

**CHAMAELEONIDAE.** *Chamaeleo adolffriederici* X, *C. anchietae* +++, *C. bitaeniatus* 101 x̄, *C. b. ellioti* ++, *C. b. graueri* X, *C. chapini* ++++, *C. dilepis* 107 x̄, *C. d. idjwiensis* +, *C. etiennei* 109 x̄, *C. gracilis* X, *C. ituriensis* +, *C. johnstoni* X, **C. namaquensis 106,** *C. oweni* X, **C. pumilis 107, C. quilensis 120,** *C. roperi* +, *C. rudis* X, *C. senegalensis* ++, *Rhampholeon spectrum* X.

In this mainly African group specialized for arboreal existence, the males are territorial and may have special organs such as horns developed for fighting. Nevertheless available figures indicate that females are larger than males,

sometimes by a wide margin. There are both oviparous and viviparous species. Broods are large in both, but especially the former, which may produce clutches of several dozen eggs.

**ANGUIDAE.** *Anguis fragilis* +, **Anniella geronimensis 94,** *A. pulchra* 102 x̄, *Diploglossus costatus* −, *D. curtissi* −, *D. occiduus* −−, *D. stenurus* −−, *D. warreni* −, **Gerrhonotus monticolus 94,** *G. moreleti* 93 x̄, **G. multicarinatus 98, G. m. webbii 98, Ophisaurus attenuatus 95,** *Wetmorena haetiana mylica* X, *W. h. surda* X.

In these serpentiform lizards the sexes are similar in most respects, but in *Gerrhonotus* and *Ophisaurus* the males have wider head and bulging temporal muscles, and the strong jaws serve for fighting in the breeding season. It is probably significant that females are larger than males in the more subterranean kinds such as European "slow worm," *Anguis*.

**LACERTIDAE. Acanthodactylus cantoris 87,** *Aporosaura anchietae* 90 m, *Eremias argus* +, *E. arguta* 93 m, *E. breviceps* −, *E. burchelli* +, *E. capensis* −, *E. guttulata* 99 x̄, *E. lineoocellata* X, *E. lugubris* 96 x̄, *E. namaquensis* 90 x̄, **E. savagei 98,** *E. undata* X, *Ichnotropis bivittata* −, **I. capensis 95,** *I. squamulosa* 95 x̄, *Lacerta agilis* 108 m, *L. a. chersonensis* 100 m, **L. melisellensis 88,** *L. muralis* 102 m, *L. m. maculiventris* 99 m, *L. pratincola* 116 m, **L. sicula 90,** *L. s. alveaoi* 92 m, *L. s. ciclopica* 94 m, *L. s. medemi* 88 m, *L. taurica* 82 m, *L. tiliquerta* −, *L. t. eiselti* 91 x̄, *L. t. maresi* 90 x̄, *L. t. pardii* −, **L. trilineata 105, L. t. media 103,** *L. vauerselli* 102 x̄, **L. viridis 93,** *L. v. chlornota* 92 x̄, *L. vivipara* 116 m, *L. wagleriana* 92 m, *L. w. antoninoi* 87 x̄, *L. w. maritlinensis* 88 m, *Meroles cuneirostris* 91 m, *Nucras delalandii* X, *N. tessellata* −, *Scapteira knoxi* −, *Tropidosaura gularis* X.

The active, diurnal, Afro-Eurasian lizards of this family are all oviparous with the single exception of *Lacerta vivipara*. There is often some sexual dichromatism, and males have wider heads with more massive jaw muscles. Males are aggressive and quarrelsome. FMR averaged 95.1 ± 1.45 in 32 kinds, and 22% had females that averaged larger than males. In *Lacerta* the range of SSD was found to be unusually large, from 116 and 112 in *L. pratincola* and *L. vivipara* to 82 in *L. taurica*.

**TEIIDAE.** *Alopoglossus atriventris* 106 m, *A. copii* 111 x̄, **Ameiva ameiva 95,** *A. auberi* 83, *A. chaitzami* −, **A. festiva 86,** *A. quadrilineata* 97 m, **A. undulata 84,** *A. u. amphigramma* X, *A. u. gaigeae* −−, *A. u. hartwegi* −−, *A. u. parva* −, *A. u. podarga* −−, **Arthrosaura kockii 107,** *A. reticulata* 86 m, *Bachia flavescens* (= *cophias* 108 x̄, *vermiforme* 99 m), *B. trinasale* 104 x̄, *Callopistes maculatus* −, *Cercosaura ocellata* 103 m, *Cnemidophorus bacatus* 92 x̄, *C. calidipes* 91 x̄, **C. deppei 93,** *C. d. infernalis* −, *C. guttatus* 93 x̄, *C. g. flavolineatus* −−, **C. hyperythrus 97, C. inornatus 104, C. lemniscatus 79, C. lineatissimus 89,** *C. l. duodecimlineata* −−, **C. parvisocius 91,** *C. sacki* 93 m, **C. sexlineatus 101, C. tigris 94,** *Iphisa elegans* 100 x̄, **Kentropyx calcaratus 97,** *K. pelviceps* 96 m, **K. striatus 89,** *Leposoma guianensis* 103 x̄, **L. parietale 105, Neusticurus bicarinatus 85,** *N. cochranae* +, **N. ecpleopus 93,** *N. rudis* X, *N. strangulatus* −, *N. tatei* −, *Opipeuter xestus* +, *Pholidobolus affinis* −, *P. macbrydei* X, *P. montium* ++, *P. prefrontale* +, **Prionodactylus argulus 100,** *P. manicatus* 123 x̄, **Proctoporus bolivianus 106,** *Ptychoglossus brevifrontalis* 111 m, **Tretioscincus agilis 107,** *Tupinambis nigrolineatus* −−−−.

The teiids are oviparous New World lizards of varied habits and small to large size. Most are tropical. *Ameiva, Cnemidophorus, Kentropyx, Tupinambis* and a few other genera comprise the macroteiids, relatively large, active, primarily terrestrial types, whereas the microteiids are small and many are secretive, fossorial, or arboreal. Active competition with fighting, for prospective mates, food, shelter, or other resources is com-

mon in macroteiids, but is not known to occur in microteiids. In the latter the females are most often the larger (12 of 18 species, mean FMR 103).

Figures are available for 20 species of macroteiids and in all but two, males were the larger, FMR averaging 92 for the entire group (Fig. 2). Macroteiids are diurnal. Chasing and fighting are prominent aspects of behavior wherever population densities are high. In most instances those activities seem not to involve territorial defense, as many individuals may share the same small area, with overlapping ranges. Fighting probably establishes dominance or priority in mating.

Macroteiids conform to a widespread trend in that the lowest FMRs are all of tropical species, whereas the two species having the females larger than males both inhabit the Temperate Zone. Clutches tend to be larger in the Temperate species which oviposit only once or a few times annually, but smaller in tropical kinds that breed throughout the annual cycle or a major part of it. The need to produce large clutches would in turn select for large body size in the females.

**SCINCIDAE.** *Ablepharus kitaibelii* 115 m, *A. smithii* X, *A. wahlbergii* 111 x̄, *Brachymeles gracilis* 93 m, **Cryptoblepharus boutoni 102, Emoia adspersa 101, E. atrocostata 97,** *E. baudini* X, **E. cyanura 99, E. lawesii 102, E. nigra 94, E. samoensis 94,** *Eumeces brevirostris* 104 x̄, *E. copei* +, *E. dugesi* X, **E. egregius 106, E. fasciatus 99, E. gilberti 90, E. g. cancellosus 97, E. g. placerensis 95, E. g. rubricaudatus 102, E. inexpectatus 98, E. latiscutatus 98, E. obsoletus 102,** *E. ochoterenae* 102 x̄, *E. septentrionalis* 101 x̄, **E. skiltonianus 101, E. s. utahensis 104,**

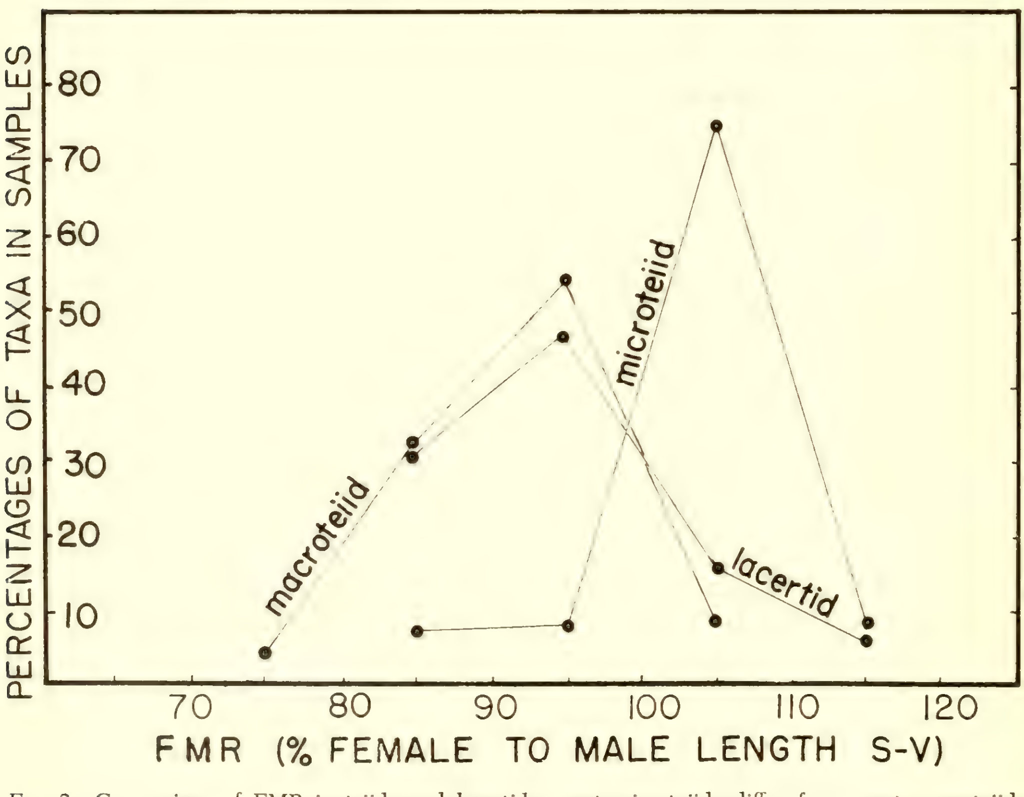


Fig. 2. Comparison of FMR in teiids and lacertids; most microteiids differ from most macroteiids and lacertids in having relatively large females.

**Leiolopisma rhomboidalis 100, Lipinia noctua 101,** *Lygosoma graueri* +, *L. kilimense* +, *L. luberoensis* −, *L. solomonis* −, *Mabuya bayoni* 105 x̄, *M. brachypoda* 101 x̄, *M. buettneri* 120 x̄, *M. capensis* X, *M. lacertiformis* +, **M. mabouya 112,** *M. m. alliacea* 106 x̄, **M. maculata 96, M. maculilabris 98,** *M. megalura* +++, *M. multifasciata* 94 m, *M. occidentalis* 108 x̄, *M. perroteti* −, **M. punctata 88,** *M. quinquetaeniata* ++, *M. q. margaritifer* 88 x̄, *M. q. obsti* X, *M. rudis* X, **M. sparsa 87, M. spilogaster 104, M. striata 101,** *M. s. chimbawa* +, *M. s. ellenbergi* X, *M. sulcata* +, *M. varia* 106 x̄, *M. variegata* 111 x̄, *Ophiomorus persicus* 119 x̄, *O. rathmai* 112 x̄, *O. tridactylus* 103 x̄, *Riopa anchietae* ++, *R. sundevalli* X, **Scincella lateralis 105,** *S. reevesi* ++, *Scincus hemprichii* −−, *S. mitratus* 79 x̄, **S. scincus 85,** *Sepsina tetradactyla* ++, **Sphenomorphus cherriei 100,** *S. megaspila* +, **Typhlosaurus garipensis 106, T. lineatus 105.**

Of 52 skinks for which definite FMRs are available, 31 had females larger, 19 had males larger and 2 had nearly equal-sized sexes (Fig. 3). FMR ranged from 79 to 120, mean 101.0 $\mp$ 1.15. Both *Eumeces* and *Mabuya* were found to be divided between species having the male larger and those having the female larger, but the latter group was somewhat more numerous. In secretive and burrowing skinks especially (*Ophiomorus* and *Typhlosaurus*), there is a tendency for females to be relatively large, and presumably male rivalry and combat is less developed among those kinds that spend most of their time underground. Among those kinds with subterranean tendencies, clutch size is reduced sometimes to only one egg, but egg size is correspondingly large.

**XANTUSIIDAE. Xantusia henshawi 111,** *X. h. bolsoni* +. In the gecko-like, viviparous granite night lizard the sexes are similar in appearance but females are markedly larger. Probably both sexes maintain territories. There are two young at a birth.

**CORDYLIDAE.** *Cordylus capensis* X, *C. coeruleopunctatus* X, *C. giganteus* X, *C. jonesi* +, *C. jordani* X, *C. polyzonus* +, *C. tropidosternum* X, *C. vandami* +, *C. warreni* ++, *Gerrhosaurus flavigularis* X, *Platysaurus capensis* X, *P. guttatus* −, *P. intermedius* −, *P. mitchelli* X, *Pseudocordylus microlepidotus* X, *P. wilhelmi* −−.

These armored African lizards usually live in rocky places. *Cordylus* is viviparous. Seemingly the group as a whole has females larger than males with some exceptions to this trend in *Platysaurus* and *Pseudocordylus.*

**VARANIDAE.** *Varanus acanthurus* 87 x̄, *V. komodensis* −−−−. The monitors range from small size up to the three meters of the giant Komodo dragon lizard. All are oviparous. The larger kinds are formidable predators. Male fighting has been observed in various species. The two species for which size data are available indicate that males are markedly larger than females.

## Squamata: Amphisbaenia

**AMPHISBAENIDAE** and **TROGONOPHIIDAE. Amphisbaena alba 103,** *A. fuliginosa* 97 m, **Blanus cinereus 100,** *Trogonophis wiegmanni* 98 x̄.

The few figures available for these wormlike reptiles indicate that the sexes are approximately the same size. There is no mention of sexual size difference in the many papers by Gans and others on amphisbaenians.

## Squamata: Serpentes

### Serpentes. (Henophidia).

**ACROCHORDIDAE.** *Acrochordus javanicus* ++++.

**ANILIDAE.** *Anilius scytale* ++++.

**BOIDAE.** *Candoia aspera* ++++, **C. carinata 137,** *Charina bottae* 112 x̄, *C. b. utahensis* 122 x̄, *Corallus caninus* +, *C. enydris* X, *Epicrates angulifer* +++, *E. cenchria* 114 x̄, *E. fordii* −−,

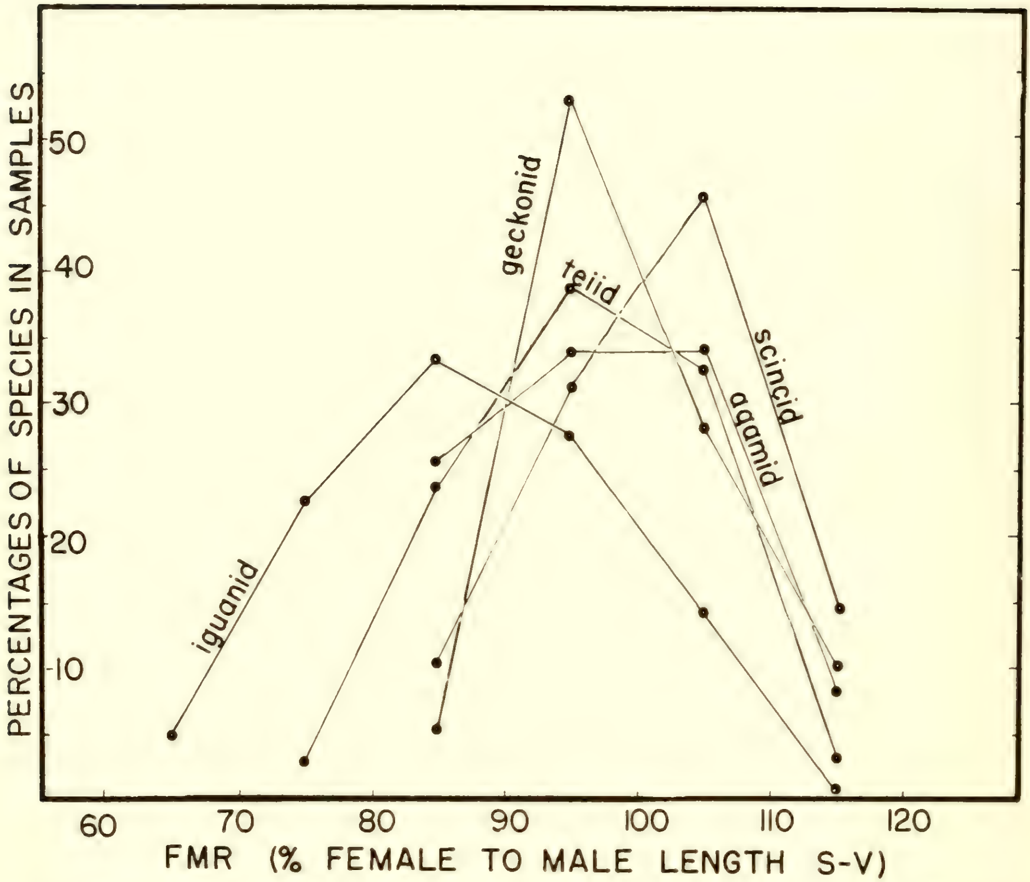


FIG. 3. Comparison of FMR trends in several families of lizards; in most species of iguanids, males are larger than females, whereas skinks tend to have relatively large females.

*E. gracilis* X, *E. striatus* –, *Eryx conicus* ++++, *E. johni* +, *Python sebae* ++++, *Tropidophis haetianus* X, *T. nigriventris* +.

**UROPELTIDAE.** *Rhinophis drummondhayi* ++++, *R. philippinus* –.

**XENOPELTIDAE.** *Xenopeltis unicolor* ++.

In these primitive snakes, the henophidians, of five families, including the highly aquatic *Acrochordus,* and the somewhat fossorial anilids, uropeltids, xenopeltids and *Charina,* it seems to be the general rule that the females are larger. In some of them the size difference between the sexes is large. These snakes are ecologically diverse. Most of the kinds listed are viviparous. Barker et al. (1979) have described male combat in *Python molurus.* Four males confined with a female fought frequently. Fighting consisted of crawling over the opponent, gouging him with the erected pelvic spurs, and biting. As a result of such encounters the males arranged themselves in a social hierarchy. Mating success was highly correlated with success in combat and position in the hierarchy. As the breeding season waned, combat ceased. Combat has been reported in one other boid, the arboreal *Sanzinia madagascariensis* (Carpenter et al., 1978).

## Serpentes (Scolecophidia).

**TYPHLOPIDAE. Typhlops angolensis adolfi 125,** *T. a. dubius* 136 $\bar{x}$, *T. a. iraci* 141 $\bar{x}$.

The figures for this African species

indicate that in the wormlike blind snakes, as in most other fossorial reptiles, females are substantially larger than males.

## Serpentes (Caenophidia).

**COLUBRIDAE.** This is by far the largest family of living snakes. Figures are available for 202 taxa classed as colubrids; in 71% of these, females were found to be larger than males, in 4% the sexes were approximately equal and in 25% males were larger. The colubrids are so diverse ecologically that few general statements apply well to the group as a whole.

Relationships among the host of colubrid genera and species are still poorly understood and existing classifications are controversial. For convenience in discussing SSD in colubrids, they are divided into subfamily groupings, following the system presented by Smith, Smith and Sawin (1977).

ALSOPHIINAE. *Arrhyton dolichurum* –, *A. taeniatum* +, *A. vittatum* –, *A. v. landoi* +, *Atractus* "species A" +, *A. badius* ++, *A. carrioni* 142 x̄, **A. elaps 111,** *A. latifrons* +++, **A. major 111,** *A. multicinctus* 110 x̄, *A. occipitoalbus* 126 x̄, *A. resplendens* +, *A. roulei* ++, *Clelia rustica* 97 x̄, *Farancia abacura* 165 m, *F. a. reinwardti* 159 m, **F. erytrogramma 149,** *Oxyrhopus melanogenys* 115 x̄, **O. petola 118,** *O. trigeminus* ++++, *Tachymenis chilensis assimilis* 87 x̄, *T. c. melanura* 106 x̄, **T. peruviana 93,** *Uromacer catesbyi* ++, *U. c. insulaevaccirum* +++, *U. c. frondicator* +++, *U. c. hariolatus* ++, *U. c. inchausteguii* ++++, *U. c. pampineus* +++.

These New World and mainly tropical colubrids are a diverse assemblage, with a wide range of sizes, habitats, and strategies of feeding and reproduction. Some are highly prolific; eggs average more than 30 per clutch in both species of *Farancia*. Females are larger than males in most, and attain maximum relative size in *Farancia*. However, males may be larger than females in *Clelia* and *Tachymenis*. In examining extensive series of *Conophis*, Wellman (1963) found females to be larger in *C. lineatus dunni* and *C. pulcher* but found males to be larger in *C. l. lineatus*, *C. l. concolor*, and *C. vittatus*.

For 14 alsophiines a mean FMR of $120.64 \pm 6.61$ was obtained.

APARALLACTINAE. *Amblyodipsas polylepis* ++++, *A. unicolor* 150 x̄, *A. ventrimaculatus* ++, *Aparallactus capensis* +, *A. guentheri* +, *A. jacksoni* X, *A. lunulatus* 131 x̄, *A. modestus* 120 x̄, *A. ubangensis* ++, *A. ulugurensis* X, *Micrelaps boettgeri* ++++, *Miodon christy* +++, *M. collaris* +++, *M. c. graueri* +, *Xenocalamus mechowi* ++++, *X. sabiensis* ++. The available evidence indicates that females are larger, often by a wide margin, in the snakes of this African subfamily.

ATRACTASPINAE. *Atractaspis bibroni* 111 x̄, *A. congica* –, *A. dahomeyensis* +, *A. irregularis* 110 x̄, *A. microlepidotus* ––, *A. m. fallax* X, *A. m. micropholis* ––.

These "false vipers" have only recently been reallocated as colubrids. They resemble viperids in having long, folding poison fangs and a fairly potent venom. Neither sex is consistently larger but in some the sexes are approximately equal, while the maximum size attained is greater in females of some kinds and in males of others.

BOIGINAE. *Ahaetulla mycterizans* ++++, *A. nasuta* ++++, *A. prasina* 122 x̄, *A. pulverulenta* ++++, *Boiga blandingii* +, *B. ceylonensis* +++, *B. cyanea* +++, *B. cynodon* ++, *B. dendrophila* 96 x̄, *B. forsteni* –, *B. gokool* +, *B. multimaculata* +++, *B. ochracea* +, *B. pulverulenta* 106 x̄, *B. trigonata* ++, *Crotaphopeltis degeni* X, **C. hotamboeia 105,** *Dipsadoboa duchesnei* ––, *D. elongata* ––, *D. unicolor* 84 x̄.

These are Asiatic and African rear-fanged snakes, mostly of arboreal habits. In the Asiatic *Ahaetulla* and *Boiga* females are larger than males, but in the African *Crotaphopeltis* the sexes are

nearly equal-sized and in *Dipsadoboa* males are larger.

BOODONTINAE. *Boaedon fuliginosus* ++++, *B. lineatus* 140 x̄, *B. olivaceus* X, *Grayia ornata* ++, *G. smythii* X, *G. tholloni* +++, *Lamprophis aurora* +++, *L. inornatus* ++++, *Lycodonomorphus laevissimus* +++, *L. leleupi* +++, *L. rufulus* +++.

In these African "house snakes" and "swamp snakes" females average much larger than males.

CALAMARINAE. **Calamaria agamensis 118,** *C. gervaisi* 126 x̄, *C. leucogaster* +, *C. linnaei* ++, **C. lumbricoidea 115,** *C. modesta* ++, **C. multiplicata 126,** *C. pavimentata* 116 x̄, *C. septentrionalis* ++, *C. uniformis* +, **C. virgulata 116,** *Trachischium fuscum* ++++, *T. guentheri* +++, *T. laeve* ++++.

In these small, secretive or fossorial Oriental snakes, females average consistently larger than males.

COLUBRINAE. *Argyrogena fasciolata* X, *Arizona elegans* X, *Chironius carinatus* −, *C. fuscus* −, **Coluber constrictor 110,** *C. jugularis* 71 m, *C. karelini* ++, *C. ravergieri* −, *C. spinalis* 126 x̄, *C. ventromaculatus* −, *C. viridiflavus* 86 x̄, **C. v. xanthurus 77, Coronella austriaca 102,** *C. brachyura* −, **Drymoluber dichrous 74, Elaphe climacophora 102,** *E. conspicillata* 100 x̄, *E. dione* 103 x̄, *E. flavolineata* 104 x̄, *E. helena* ++++, *E. hodgsoni* −−, *E. longissima* 86 m, **E. obsoleta 96,** *E. porphyriaca* 100 x̄, **E. quadrivirgata 92,** *E. radiata* 108 x̄, *E. taeniura* ++, **Elapoides fuscus 110, Gongylosoma baliodeira 108,** *Gonysoma oxycephala* +, **Leptophis ahaetulla 91,** *Liopeltis calamaria* ++, *L. frenatus* −, *L. rappi* X, *L. scriptus* X, *L. stoliczkae* −, *Lytorhynchus diadema* −, **Masticophis lateralis 106,** *M. taeniatus* 95 m, *M. t. ruthveni* 96 m, *Meizodon coronatus* +, *M. semiornatus* +++, *Opheodrys aestivus* 100 m, *O. major* 83 x̄, *O. multicinctus* −−, *O. vernalis* 101 x̄, **Pituophis melanoleucus affinis 104,** *P. m. catenifer* 95 m, **P. m. deserticola 91, P. m. sayi 101, Ptyas korros 92, P. mucosus 94,** *Salvadora grahamiae* X, *S. hexalepis* 90 m, *S. h. mojavensis* 84 m, *S. h. virgultea* 91 m, **S. lemniscata 97, S. mexicana 87, Spalerosophis cliffordi 107,** *S. diadema* ++.

The snakes of this almost cosmopolitan subfamily are medium-sized or large, active, diurnal, and with few exceptions are egg-layers. Some are constrictors; some are arboreal but most are terrestrial. They differ from the majority of snakes in tending to have males larger than females, but there is much difference between genera and species in this regard. Among 37 taxa males were larger in 23, sizes were equal in 3 and females were larger in 11. In these 37 taxa for which substantial series were available FMR averaged 96.0 ± 1.40. In the North American racer, *Coluber constrictor,* females are considerably larger than males (FMR 110), but in some of the Old World species of *Coluber* the opposite relationship applies, FMR 71 in *C. jugularis,* and 77 in *C. viridiflavus xanthurus.* Probably male aggression or combat occurs to some degree in all of these snakes. It has been known since ancient times in at least the aesculapian snake *Elaphe longissima;* the caducis which symbolizes the medical profession, is a representation of male combat in this species (FMR 87). Rigley (1971: 65) first described male combat under natural conditions in *Elaphe obsoleta.* Two of the snakes were lying with their tails and posterior parts of their bodies intertwined while the anterior parts were swaying and looping. Each seemed to be striving to hold down and press against the ground the head and forebody of the opponent. Stickel, Stickel and Schmid (1980) observed male combat twice in their 22-year study of a rat snake population. There was spiral twisting of the bodies as each snake seemed to be striving to keep its head in a superior position and force its opponent to the ground. Once the aggressor bit the other snake. One encounter lasted three minutes and the other 45 minutes. One of the same snakes was

involved in both encounters. Bogert and Roth (1966) described male combat in the gopher snake *(Pituophis melanoleucus).*

DASYPELTINAE. *Dasypeltis atra* +++, *D. fasciata* ++, *D. scabra* 117 x̄.

The African egg-eaters differ from other snakes in morphological features associated with their specialized feeding habits. Their relationships are uncertain. Females are relatively large.

DIPSADINAE. **Carphophis vermis 117,** *Coniophanes bipunctatus* ++++, **C. fissidens 114, Diadophis punctatus 111, Dipsas catesbyi 96,** *D. pavonina* –, *D. variegata* X, *Ficimia olivacea* 95 x̄, **Ficimia quadrangularis 95,** *Geophis brachycephalus* 117 m, *G. hoffmanni* 132 m, *G. nasalis* 105 m, *G. rhodogaster* 124 m, *G. semidoliatus* 129 m, **Gyalopion canum 106,** *Hypsiglena torquata* +++, *Imantodes cenchoa* 109 x̄, **Leptodeira annulata 108,** *L. a. ashmeadi* ++, *L. a. cussiliris* +++, *L. a. rhombifera* ++, *L. frenata* ++, *L. nigrofasciata* +, *L. polysticta* ++, *L. punctata* +, *L. septentrionalis* +++, *L. s. ornata* +++, *Pseustes poecilonotus* +, *Rhadinea brevirostris* –, *R. calligaster* +++, *R. decorata* +, **R. flavilata 112,** *R. fulvittis* +, *R. gaigeae* ++, *R. hesperis* +++, *R. laureata* ++, *Sibon dimidiata* –––, *S. nebulata* X, *S. n. leucomelas* X, *S. sanniola* –, *Sibynomorphus mikani* ++, *S. ventrimaculatus* +, **Tantilla gracilis 126,** *T. melanocephala* +, *T. planiceps* 94 m, **Tretanorhinus nigroluteus 141,** *Trimorphodon biscutatus lambda* 130 x̄, *T. b. vandenburghi* 127 m, *T. b. lyrophanes* +.

The dipsadines are New World snakes that are mostly medium-sized or small, nocturnal and/or secretive-fossorial, predatory on invertebrates such as earthworms, slugs, snails, and soft-bodied insects, or on frogs, and in a few cases, on lizards or small snakes. Most are tropical. All are oviparous. Females were found to be larger than males in 16 of the 19 species for which series were available, but *Sibon* is an exception to this general trend. FMR averaged 114.32 ± 2.85. To my knowledge, male combat or rivalry has not been recorded in any dipsadine.

DISPHOLIDINAE. *Dispholidus typus* 102 x̄, *Telescopus dhara* ++++, *T. semiannulatus* 128 x̄, *Thelotornis capensis* 100 x̄, *T. kirtlandi* +. These are arboreal African rear-fanged snakes, the boomslangs, large-eyed snakes and twig snakes. Females tend to be larger than males.

GEODIPSANAE. *Geodipsas depressiceps* 116 x̄, *Psammodynastes pulverulentus* 109 x̄.

The mock vipers and their relatives are rear-fanged terrestrial Old World snakes. Females are larger than males. In *Psammodynastes* there is color dimorphism in the sexes.

HOMALOPSINAE. *Cerberus rhynchops* 118 x̄, *Enhydris chinensis* +, *E. bocourti* ++++, **E. enhydris 109,** *E. plumbea* +, *Fordonia leucobalia* 119 x̄, **Homalopsis buccata 109.**

These heavy-bodied viviparous rear-fanged snakes occur in freshwater or estuarine habitats of southeastern Asia and the Indo-Australian Archipelago. They have usually been placed in a family separate from the Colubridae. Females are consistently larger than males.

HYDROPSINAE. *Helicops angulatus* ++. Like other groups of aquatic snakes, this Neotropical genus has females larger than males.

LAMPROPELTINAE. *Cemophora coccinea* 79 x̄, **Lampropeltis calligaster 91, L. getulus 87, L. g. boylii 95, L. g. holbrooki 88,** *L. multicincta* 112 m, *L. pyromelana* 91 m, *L. triangulum* 88 x̄, *L. t. elapsoides* 88 x̄, **L. t. syspila 97,** *Rhinocheilus lecontei* 87 m, *R. l.* "*clarus*" 91 m, *R. l. tessellatus* ––, *Stilosoma extenuatum* 104 m. In these oviparous North American constrictors males are usually larger than females (FMR averaged 91.5 ± 1.90 for 13 taxa). Male competition and combat has been noted in various kinds of king snakes. An excellent account of fighting in *L. calligaster* was that of Moehn (1967). Two males were

found engaged in a "combat dance." They were captured and caged together, and fighting continued intermittently over a period of days. It involved rearing and attempting to throw down the opponent with coiling and jerking movements, but also involved pursuit and vicious biting.

LYCODONTINAE. *Dinodon flavozonatum* 83 x̄, *D. orientale* 100 m, *D. rufozonatum* 96 x̄, *Lycodon aulicus* +, *L. jara* +, *L. subcinctus* +, *L. travancoricus* +.

These are nocturnal, oviparous, Asiatic snakes; *Dinodon* species average considerably larger than those of *Lycodon.* The limited data available indicate that the females are larger in *Lycodon,* but males tend to be larger in *Dinodon.*

LYCOPHIDIINAE. *Lycophidion variegatum* +, *L. capense* 133 x̄, *L. laterale* X, *L. ornatum* +++, *L. semiannule* X, *Mehelya capensis* ++, *M. poensis* ++++, *M. savorgnanii* ++, *M. stenophthalmus* ++++, *Natriciteres olivacea* 125 x̄.

The wolf snakes, file snakes and marsh snakes of this subfamily are African and tend to nocturnality and to lizard- or frog-eating habits. To varying degrees the females are larger than the males.

NATRICINAE. *Amphiesma beddomei* ++, *A. craspedogaster* +, *A. khasiensis* +, *A. modesta* +++, *A. monticola* ++, *A. platyceps* −, *A. popei* X, *A. pryeri* ++, *A. sauteri* 116 x̄, *A. sieboldi* +++, **A. stolata 133,** *A. venningi* +, *A. vibakari* X, *A. xenura* X, *Aspidura copi* +, *A. trachyprocta* ++++, *Atretium schistosum* 120 x̄, *Balanophis ceylonensis* −, *Clonophis kirtlandi* 110 m, *Haplocercus ceylonensis* X, *Macropisthodon plumbicolor* ++++, *M. rudis* 139 m, **Natrix annularis 138,** *N. natrix* 114 m, **N. n. sicula 115,** *N. percarinata* 136 x̄, *N. tessellata* 103 m, **N. trianguligera 118,** *Nerodia cyclopion* 124 m, *N. erythrogaster bogerti* 107 x̄, **N. e. transversa 115,** *N. fasciata* 116 m, *N. f. clarki* ++++, *N. f. confluens* 132 m, *N. f. pictiventris* 152 m, **N. rhombifera 111, N. r. blanchardi 120, N. r. werleri 162, N. sipedon 132,** *N. s. insularum* 108 m, *N. s. pleuralis* 124 m, *N. taxispilota* 117 m, **N. valida 135, N. v. celaeno 109, N. v. isabelleae 142, N. v. thamnophisoides 121,** *Opisthotropis latouchi* +, *Pseudoxenodon macrops* −, *P. nothus* −, *Regina alleni* 106 m, **R. grahami 120,** *R. rigida* 134 m, **R. septemvittata 114,** *Rhabdophis auriculata* +, *R. a. myersi* ++, **R. chrysarga 106,** *R. himalayana* ++++, *R. nigrocincta* X, *R. nuchalis* ++++, **R. subminiata 122, R. tigrina 120,** *Rhabdops bicolor* +, **Seminatrix pygaea 110, Storeria dekayi texanum 120, S. d. victa 120, S. occipitomaculata 118,** *Thamnophis brachystoma* 112 m, **T. butleri 109,** *T. couchi* 132 m, *T. c. gigas* 134 m, *T. c. hammondi* 136 m, *T. c. hydrophilus* 130 m, *T. cyrtopsis* 146 m, *T. elegans* 118 m, *T. e. biscutatus* 138 m, *T. e. terrestris* 106 m, **T. e. vagrans 122,** *T. eques* 115 x̄, *T. marcianus* 126 m, **T. ordinoides 125, T. proximus 110,** *T. radix* 108 m, *T. rufipunctatus* ++, **T. sauritus 118, T. sirtalis 114, T. s. parietalis 123, T. s. pickeringi 124, Tropidoclonion lineatum 122, Virginia striatula 116, V. valeriae 124,** *Xenochrophis cerasogaster* 153 x̄, **X. piscator 135,** *X. punctulata* ++, **X. vittata 124,** *Xylophis perroteti* ++.

This large subfamily of holarctic colubrids, including the water snakes, garter snakes and their relatives, are active, diurnal or nocturnal, and many have aquatic or wetland habitats. They are mostly medium-sized or small, and feed on a variety of vertebrate and invertebrate prey, but especially on fish. In general, members of this group are "*r*-selected," with rapid development, large clutches or litters and rapid population turnover. All species in the nine North American genera are live-bearers, whereas the much more diverse Asiatic species are oviparous, with the single exception of *Natrix annularis.* Regardless of these differences, it is a general rule that females are larger but *Pseudoxenodon* is an apparent exception. In

63 taxa for which definite figures were available, FMR averaged 122.05 ∓ 1.52 (Fig. 4). It averaged 122 for 20 kinds of *Thamnophis* (Table 7) and 124 for 13 kinds of *Nerodia*. In various natricines mating aggregations have been observed, with complete lack of male rivalry. Several males may simultaneously court the same female, their massed bodies forming a "snake ball." With no rivalry or combat between males, large male size would confer no selective advantage, but large size in the female enables her to produce a relatively large clutch or litter. Primiparous females are much smaller and less prolific than others, but successive broods become progressively larger as the female gains in bulk.

TABLE 7. Mean Female to Male Ratios (FMR) in *Thamnophis*.

| Species grouping | Number of taxa | Mean FMR | $\sigma^m$ | Range |
|---|---|---|---|---|
| All species tested | 20 | 122.30 | ±2.50 | (106-146) |
| Aquatic species | 6 | 136.00 | ±2.31 | (130-146) |
| Marshland species | 9 | 118.00 | ±2.31 | (108-126) |
| Terrestrial species | 5 | 114.00 | ±3.38 | (106-125) |

NOTHOPSINAE. *Ninia maculata* 107 x̄.

In the diminutive and secretive Neotropical "coffee snake" females are larger than males.

OLIGODONTIDAE. *Holarchus violaceus* 87 x̄, *Oligodon barroni* +, *O. catenata* X, *O. cinereus* +, *O. cruentatus* ++, *O. cyclurus* ——, *O. melaneus* —, *O. splendidus* X, *O. taeniatus* X, *O. taeniolatus* +, *Phyllorhynchus browni* —, *P. decurtatus nubilus* 110 m, **P. d. perkinsi 97.**

Size relationships of the sexes are variable in this group including the Asiatic oligodons and the North American leaf-nosed snakes.

PAREATINAE. **Pareas carinatus 100,** *P. margaritophorus* +++, *P. monticola* +++.

These are slender, short-headed, nocturnal, often arboreal snail-eating snakes of southeastern Asia and nearby islands. Females considerably exceed male size in some.

PHILOTHAMNINAE. *Chrysopelea paradisi* 124 x̄, *Dendrelaphis picta* 114 x̄, *Gastropyxis smaragdina* ++, *Philothamnus heterodermus* +, *P. hoplogaster* 120 x̄, *P. inornatus* ++, *P. irregularis* 133 x̄, *P. natalensis* ++, *P. ornatus* ++++, *P. semiornatus* X, *P. semivariegatus* 103 x̄, *Thrasops jacksoni* 126 x̄.

This small subfamily includes the

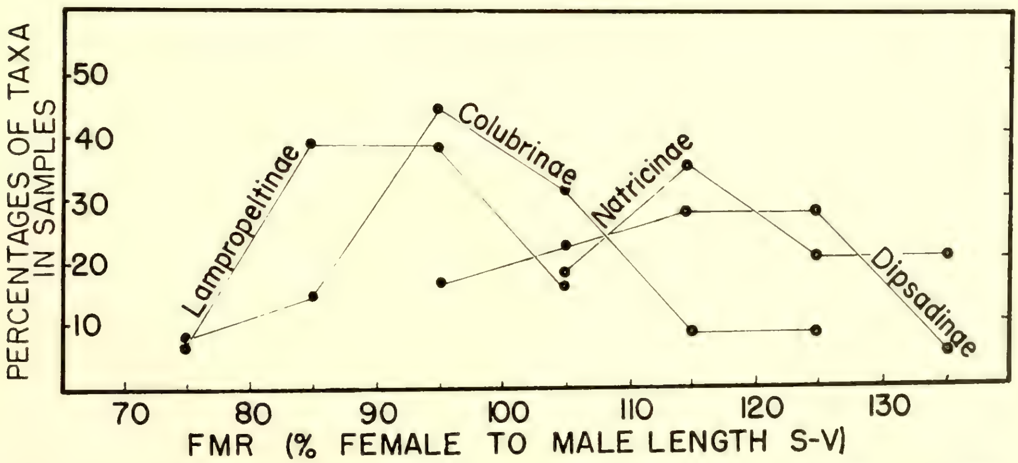


FIG. 4. Comparison of the trends of FMR in four subfamilies of colubrid snakes; females are larger than males in most dipsadines and natricines, whereas the reverse size relationship exists in most colubrines and lampropeltines.

"flying snakes" of southeastern Asia, and the green snakes and tree snakes of Africa. All are active and arboreal, feeding on lizards and sometimes on birds. Females are larger than males.

PSAMMOPHIINAE. *Hemirhagerrhis nototaenia* 105 x̄, *Psammophis angolensis* +, *P. crucifer* X, *P. jallae* −−, *P. punctulatus* −, *P. schokari* 77 m, **P. sibilans 82,** *P. subtaeniatus* −, *Psammophylax tritaeniatus* 93 x̄, *Rhamphiophis acutus* 87 x̄.

The African bark snakes, sand snakes, and skaapstekers of this group are mainly terrestrial and diurnal rear-fanged colubrids. Seemingly males are substantially larger than females in most members of the group, especially in the genus *Psammophis.*

PSEUDASPINAE. *Duberria lutrix* 118 x̄, *D. rhodesiana* +++, *D. variegata* ++++, *Prosymna ambigua* 117 x̄, *P. bivittata* ++++, *P. jani* ++, *P. lineata* −, *P. sundevallii* ++++, *Pseudaspis cana* X.

This African subfamily includes the diminutive, viviparous slug-eaters, water snakes, the fossorial shovel-nosed snakes, and the large, viviparous, rodent-eating mole snake. Of the latter, FitzSimons (1962) wrote that ". . . males have been observed to fight fiercely and gnash each other severely with their teeth." However, the entire group seems to be characterized by relatively large females.

SONORINAE. **Sonora episcopa 100,** *S. michoacanensis* 104 x̄, **S. semiannulata 99.**

In these small and secretive North American snakes, the FMR is near parity; either females or males may be slightly larger. Male combat has been described in *S. episcopa* by Kroll (1971). In a group of the snakes captured in mid-March and confined together, fighting was observed on 17, 19 and 20 March. It involved biting an opponent and intertwining with him, and was associated with mating. Males were observed to interrupt their courtship to attack a second male that approached the pair.

XENODONTINAE. *Heterodon nasicus* 125 x̄, **Xenodermus javanicus 111.**

These small colubrids of southeastern Asia are predatory on frogs and invertebrates. Females are larger than males.

XENODERMATINAE. *Achalinus spinalis* 116 m, *H. platyrhinos* 107 m, **Leimadophis reginae 112,** *L. taeniurus* 105 x̄, **Liophis miliaris 124,** *Xenodon rabdocephalus* ++, **X. severus 96.** These are small to large New World snakes that feed largely on toads, frogs and invertebrates. The few available records suggest that females are usually larger than males, or if males are larger the disparity is small.

**ELAPIDAE.** *Aspidelaps scutatus* +, *Bungarus bungaroides* −−−, *B. candidus* −, *B. fasciatus* −, *B. multicinctus* −, *B. walli* −, *Calliophis calligaster* −, *C. c. gemianulus* −, *C. japonicus* −−, *C. maclellandi* +++, *C. maculiceps* ++, *Dendroaspis angusticeps* X, *D. jaimesoni* +, *D. polylepis* X, *Elapsoidea guentheri* X, *E. loveridgei* −, *E. l. collettii* +, *E. semiannulata* X, *Hemichatus hemichatus* ++++, *Laticauda colubrina* ++++, *L. laticauda* ++, *Maticora intestinalis* 99 x̄, *Micrurus alleni* ++, **M. fulvius 134, M. f. tenere 119,** *M. langsdorffi* +, *M. nigrocinctus* +++, *M. spixii* −−−−, *Naja haje* −, *N. melanoleuca* 85 x̄, *N. mossambica* X, **N. naja 99,** *N. n. samarensis* +, *N. nigricollis* 102 x̄.

Although the Australian proteroglyphs are no longer considered elapids, the group still includes highly diverse genera of American, African and Asiatic snakes, and may be polyphyletic. Within the group, medium to large size and snake-eating habits are common. All except *Hemichatus* are oviparous. In *Hemichatus* FMR is especially high, and for the group as a whole the usual condition seems to be that of having the females larger. The Asiatic coral snakes and kraits, *Bungarus* and *Calliophis,* are exceptions, having males larger than females. The primitive oviparous seasnakes or "sea kraits" of the genus *Laticauda* are now considered elapids not closely

related to hydrophiine seasnakes (Smith et al., 1977). In *Laticauda* females are larger than males.

**HYDROPHIIDAE.** This family is now construed to include not only the true sea snakes (hydrophiines) but also the primitive terrestrial Australian proteroglyphs that have formerly been considered elapids (oxyuranines; Smith et al., 1977). The two subfamilies are much different ecologically, and their representatives are therefore listed and discussed separately.

HYDROPHIINAE. *Astrotia stokesii* +++, *Enhydrina schistosa* 111 x̄, *Hydrophis brookei* X, *H. caerulescens* −, *H. cyanocinctus* ++, *H. fasciatus* −, *H. klossi* +, *H. lapemoides* X, *H. mammillaris* X, *H. obscurus* +, *H. ornatus* −, *H. spiralis* +, *H. stricticollis* X, *H. torquatus* 97 x̄, *Kerilia jerdoni* 103 x̄, **Lapemis curtus 100,** *Microcephalus cantoris* ++, *M. gracilis* +, **Pelamis platurus 118,** *Praescutata viperina* −, *Thalassophis anomalus* −.

The sea snakes are medium-sized to large viviparous, marine, fish-eaters. Compared with terrestrial snakes they are less prolific, having only one or two young at a birth in some instances. Even in the tropical climates where most occur, there is a brief annual breeding season. Large-scale mating aggregations have been observed (Smith, 1943). Apparently mating is promiscuous in these aggregations. There are no records of male competition or combat.

Of the 20 species for which information is available, five apparently have males larger than females, five have the sexes about equal and 10 have females larger than males. Large series are available to compare sizes of the sexes only in *Enhydrina schistosa, Lapemis curtus* and *Pelamis platurus*. In the latter species Kropach (1975) found a mean length S-V of 452 mm in 359 males and 481 mm in 391 females, FMR 109, but the series included immatures as well as adults. Kropach also listed the lengths of 100 of the largest individuals and found 70 were females. Means for the 30 largest of each sex were utilized to calculate FMR of 118.

OXYURANINAE. **Acanthophis antarcticus 131, Austrelaps superbus 92, Cacophis kreftii 112, C. harriettae 125, C. squamulosus 129, Hemiaspis signata 99, Notechis scutatus 99, Pseudechis porphyriacus 95, Urechis gouldi 83, Vermicella annulata 139.**

The Australian proteroglyphs, perhaps more than any other snakes, are noted for male combat. Worrell (1964) described this behavior as follows:

> Coinciding with the mating season is the spectacular wrestling of the males . . . . One or more males may pursue each other over rocks, through creeks and scrub, twining around each other, wrestling and crawling frenziedly about the bush, flattening the grass as they writhe, and stopping occasionally to lift their forebodies high, swaying nervously.

It is significant that of the species checked, only those of the small secretive *Cacophis* and *Vermicella* and the sluggish, viperlike *Acanthophis* were found to have females larger than males. Male combat has not been observed in these two genera, and probably does not occur. Shine (1980c) emphasized the viperlike appearance, behavior, and reproductive and feeding strategy of the Australian death adder as a case of evolutionary convergence.

**VIPERIDAE.** *Atheris nitschei* ++, *A. squamiger* 113 x̄, **Bitis arietans 93,** *B. caudalis* X, *B. cornutus* −−, *B. gabonica* ++, *B. nasicornis* +++, *B. paucisquamata* +, *B. peringueyi* ++, *Causus defilipii* X, *C. lichtensteini* 115 x̄, *C. lineatus* +, *C. resimus* +, *C. rhombeatus* 95 x̄, *Cerastes cerastes* 120 x̄, *Echis carinata* 129 m, **E. colorata 98,** *Pseudocerastes fieldi* 108 x̄, *Vipera ammodytes* 118 m, **V. berus 108,** *V. latastei* 90 x̄, *V. superciliaris* +, **V. ursini 110, V. xanthina 95.**

These are venomous front-fanged snakes of Africa and Eurasia. Most are heavy-bodied and slow-moving, securing their prey by ambush and the venomous

bite. For 13 species FMR averaged 107 (90-129). Most species have females larger than males, and most are viviparous, producing medium to large litters. Relatively large size of the female makes possible the production of large litters. However, there is male combat in vipers, and in fact males of *Vipera berus* are known to be territorial. In a study of the diminutive *V. ursini,* Bruno (1967a) found that FMR increased from 104 in Yugoslavia to 105 in Italy and 110 in France. The Yugoslavian vipers were found to be the largest and the Italian were the smallest. St. Girons (1978) noted that the sexes are about the same size in *Vipera aspis* and probably in *V. kaznakovi,* whereas males are the larger in *V. ammodytes* and females are larger in *V. berus, V. seoanei* and *V. ursini.* All these are small vipers of cold and temperate climates of Europe and Asia.

**CROTALIDAE.** *Agkistrodon acutus* +, *A. blomhoffi brevicaudus* X, *A. b. siniticus* X, *A. caliginosus* X, *A. cognatus* −, **A. contortrix 94,** *A. halys* 112 x̄, *A. himalayanus* X, **A. piscivorus 96,** *A. rhodostoma* +++, *A. saxatilis* −, **Bothrops atrox 115,** *B. bilineatus* +++, **B. lansbergi 101, B. nasutus 96,** *B. neuwiedii* X, *B. pulcher* 153 x̄, *B. punctatus* 144 x̄, **B. schlegelii 111, Crotalus atrox 91, C. cerastes 103, C. durissus 88, C. d. terrificus 97, C. enyo 92, C. horridus 94,** *C. lepidus* 82 x̄, **C. l. klauberi 85, C. lucasensis 87, C. mitchelli 94, C. m. pyrrhus 78, C. m. stephensi 88, C. molossus 91, C. m. nigrescens 84, C. pricei 82, C. ruber 84, C. scutulatus 88, C. tigris 82, C. triseriatus 90, C. viridis 92, C. v. concolor 88, C. v. helleri 80, C. v. lutosus 90, C. v. nuntius 78, C. v. oreganus 87,** *Hypnale hypnale* ++, *H. walli* −, **Sistrurus catenatus 92,** *S. ravus exiguus* 76 x̄, *Trimeresurus albolabris* 161 x̄, *T. cantoris* ++++, *T. elegans* X, *T. erythrurus* ++++, *T. flavomaculatus* ++++, **T. flavoviridis 89,** *T. gramineus* +++, *T. jerdoni* ++, *T. kaulbacki* +, *T. labialis* +, *T. macrolepis* ++++, *T. malabaricus* +++, *T. microsquamatus* X, *T. monticola* ++++, **T. okinavensis 99,** *T. puniceus* 139 x̄, *T. purpureomaculatus* ++++, *T. stejnegeri* 109 x̄, *T. strigatus* +, *T. tokarensis* −−, *T. trigonocephalus* ++++, *T. wagleri* X.

The pit vipers are now generally considered to be a subfamily of the Viperidae. These New World and Asiatic solenoglyphs are mostly medium-sized to large, heavy-bodied and slow-moving ambush hunters, predatory on vertebrates. They rely on potent venom to subdue the prey. Most are live-bearers, but a few Asiatic species of *Agkistrodon* and *Trimeresurus* as well as the Neotropical *Lachesis* are oviparous. In most species of *Trimeresurus* females are markedly larger than males, but males are larger than females in 24 of 25 kinds of rattlesnakes. The exception is *Crotalus cerastes* in which FMR is 103 and for the entire group FMR averages 87.6 ± 1.19 (Table 10). Females are relatively small in *C. mitchelli pyrrhus* (77) and *C. viridis nuntius* (78) whereas in *C. molossus nigrescens* the ratio is near parity (99). There is no obvious correlation with body size, nor with climate. Rival male rattlesnakes approach each other, rear with their ventral surfaces in contact, and with sudden jerky motions each attempts to throw down its opponent. The larger and heavier snake is usually the winner but sometimes only after a prolonged bout; the loser withdraws from the encounter and leaves the area. Large size in the male would seem to confer selective advantage. Whether some species of rattlesnakes are more inclined to rivalry and combat than others is still unknown.

In the copperhead *Agkistrodon contortrix* and the cottonmouth *A. piscivorus,* the FMRs 93 and 96 were similar to those found in rattlesnakes. Both these species are known to have a combat dance, similar to that of rattlesnakes except in details. Whether the same applies to the Asiatic species is not known, but published figures on maximum sizes indicate that in some of them the fe-

males are the larger including *A. blomhoffi siniticus*, *A. acutus* and *A. halys*. Males are the larger in *A. halys cognatus*, *A. saxatilis* and *A. blomhoffi brevicaudus*, while in *A. caliginosus* the sexes seem to be equal. In the Asiatic *Hypnale walli* males are the larger. In the Neotropical *Bothrops* and the Asiatic *Trimeresurus* females are usually much larger than males.

## Crocodylia

**CROCODYLIA. Alligator mississippiensis 82, Crocodylus niloticus 85.**

The alligator was studied in Louisiana by Chabreck and Joanen (1979) from 2500 young captured, marked and released, and 218 recoveries, some after attainment of adult size. The data indicated that in both sexes growth continued long after sexual maturity, but at reduced rates, slowing earlier and more abruptly in the female. The following average total lengths in meters were calculated or projected:

| | | |
|---|---|---|
| 10-year-olds | males 2.55 | females 2.10 |
| 20-year-olds | males 3.50 | females 2.55 |
| oldest | males 4.2 | females 2.73 |

At the age of ten years, both males and females were sexually mature but still growing rapidly; at age 20 females were near their maximum size but males were still capable of substantial gain. FMR was 82 for 10-year-olds, 73 for 20-year-olds and 65 for the oldest. The latter is one of the lowest FMR figures recorded for reptile species.

Cott (1961) indicated the following total lengths and weights for mature *Crocodylus niloticus:*

| | | | |
|---|---|---|---|
| Males | (14) | 3.416 m | (3.073-3.743) |
| | | 170.8 kg | (115.8-240.0) |
| Females | (50) | 2.911 m | (2.600-3.192) |
| | | 104.2 kg | ( 70.2-146.2) |

In this crocodile SSD is large, but less than in *Alligator mississippiensis*. Probably males are substantially larger than females in most crocodilians, with similar trends of widening SSD with advancing age, but definite figures are not available. Staton and Dixon (1977) in a study of *Caiman crocodylus* observed instances of coitus in which males appeared to be 1.7 to 2.5 m in length and females 1.2 to 1.5 m. However, Brazaitis (1973) noted that in the small *Alligator sinensis* the female is larger than the male. Presumably this was mentioned because it is the exception, and size relationships of the sexes were not indicated for other kinds of crocodilians in Brazaitis' review.

Crocodilians are known to maintain territories, and male aggression and combat are common. Garrick and Lang (1977) compared social behavior in *Alligator mississippiensis, Crocodylus acutus* and *C. niloticus*. They found that in all three species combat between males contesting for dominance precedes the establishment of mating territories. Voice is prominent in social behavior. Both sexes "bellow," especially in the breeding season. The bellowing alligator is usually in the water. The sound is accompanied by stereotyped movement with raising of the head and arching of the tail, and, in the male, eversion of the submaxillary gland. Bellowing signals the presence and location of the individual as a member of a social group (Garrick, Lang and Herzog, 1978). Territorial males dominate the breeding groups. In *A. mississippiensis* alpha males have been observed to interrupt courtship of subdominants. Females show submissive behavior in the presence of territorial males but may form dominance hierarchies among themselves. They move freely from one male's territory to another.

Selective factors which might tend to increase female size in crocodilians are: (1) large clutch size, and the need to increase the capacity of the female; (2) Cannibalistic predation on the dependent young, and the need for maternal defense against other adults, including males. Factors which might select for increased male size are direct competition for females, or for breeding ter-

ritories, and the existence of social hierarchies. Stress associated with breeding and competition for mates is intensified because it is concentrated in a relatively short breeding season in all species.

## DISCUSSION

Extensive sampling, comparing sizes of the sexes in many species of reptiles, has demonstrated SSD to be extremely labile within the class. Females ranged in size from just over one-fourth to about 15 times male bulk in a virtual continuum. Within each of the main groups, turtles, lizards and snakes, also, was found a wide range of SSD, and to a lesser degree the same statement applied to families, subfamilies and genera (Tables 8 to 11). Even individual species proved to have important differences in SSD from one population to another, and seemingly SSD is highly susceptible to selective pressure bringing about evolutionary change. Also, direct environmental influences may alter SSD.

In turtles and snakes it is most common for females to exceed males in average size, whereas in lizards the opposite relationship is more common. However, in each group many exceptions from the general trend are found and these aid in identifying some of the factors which were the basis for natural selection producing sexual size differences. Rivalry and aggression in males promote selection for large individuals of that sex; selection for large clutches or litters, and for relatively large neonates may result in selection of relatively large females.

The seven reptile species noted as having the lowest FMRs, 70 or less (minimum 66) are all insular West Indian iguanids, *Anolis* (5 species) and *Leiocephalus* (2 species). It has already been shown under the discussion of *Anolis,* that relative size of females averages markedly smaller in the insular species than in those of the mainland. This condition is associated with generally high population densities, light predation pressure, and intense intraspecific competition in the insular species. Divergence in sizes of the sexes alleviates intraspecific competition for food (Schoener, 1967).

One of the seven species with lowest FMR, *Anolis lineatopus* (FMR 69) of Jamaica has been the subject of an intensive ecological study (Rand, 1967). These findings are of special interest

TABLE 8. Distribution Of FMR Percentages Within The Turtles, Lizards, Snakes And Major Families Of These Groups.

| | Female length as percentage of male length (FMR) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Number of taxa | <80% | 80-89% | 90-99% | 100% | 101-110% | 111-120% | 121-130% | >130% | Total |
| Turtle | 50 | – | 4% | 18% | 8% | 20% | 8% | 2% | 40% | 100% |
| Emydid | 28 | – | – | 11% | 7% | 14% | 11% | – | 57% | 100% |
| Lizard | 408 | 11% | 21% | 33% | 2% | 27% | 6% | 1% | – | 100% |
| Geckonid | 43 | – | 5% | 26% | 9% | 51% | 9% | – | – | 100% |
| Iguanid | 226 | 20% | 27.5% | 31% | 1% | 17% | 2.5% | 1% | – | 100% |
| Agamid | 12 | – | 25% | 34% | – | 33% | 8% | – | – | 100% |
| Lacertid | 32 | – | 19% | 56% | 3% | 16% | 6% | – | – | 100% |
| Teiid | 38 | 3% | 18% | 37% | 5% | 29% | 5% | 3% | – | 100% |
| Scincid | 51 | 2% | 8% | 26% | 4% | 46% | 14% | – | – | 100% |
| Snake | 278 | 2.5% | 11.5% | 19% | 3% | 19% | 20.5% | 12% | 12% | 100% |
| Colubrid | 214 | – | 7.5% | 14% | 3% | 19.5% | 22.5% | 14% | 12.5% | 100% |
| Elapid-hydrophiid | 21 | – | 9% | 33% | 5% | 10% | 19% | 10% | 4% | 100% |
| Viperid | 13 | – | – | 38% | – | 23% | 31% | 8% | – | 100% |
| Crotalid | 41 | 7% | 34% | 34% | – | 8% | 7% | – | 10% | 100% |

because *A. lineatopus* is suspected to be representative of various other lizards that have relatively large males and small females in its social system and reproductive strategy. As in other anoles, the females lay one egg per clutch, but oviposition is frequent and breeding occurs throughout the year. Hatchlings are intolerant of each other and from the start they space themselves and defend territories. However, they avoid adults and are subject to cannibalistic predation. Individuals of both sexes and all sizes are territorial, but agonistic behavior is directed mainly against similar-sized individuals. Hence, territories may overlap extensively. An adult female may have several mutually exclusive juveniles living within her territory. Small lizards avoid larger ones, and are generally ignored or sometimes briefly chased by them. A male's territory may encompass those of several females and he may mate with them regularly. Males spend much of their time in territorial display. One male observed for an entire day displayed on the average, every 3.5 minutes. However, there is little precopulatory display or courtship. Females are individually recognized. Mating occurs when an approached female is receptive and does not move away to avoid the male. Nonreceptive females flee and escape the male easily. Immature males may compete with similar sized females for territories. Also, they may be treated as females by courting adult males, but invariably flee from the male's approach. On the average males use larger and higher perches than do other individuals. Although displays usually serve to maintain territorial spacing, rival males fight fiercely at times. Combat usually involves threatening approach, sparring, and biting with jaws interlocked. Usually one combatant is thrown from perch to ground. Combats usually are brief and do not result in serious injury to either participant.

Forty-four additional species of reptiles were found to have notably low FMRs in the range from 71 to 80. These included seven species of snakes *(Crotalus, Coluber, Cemophora, Drymoluber, Psammophis, Sistrurus)* but were mostly lizards. The latter included a skink *(Scincus)* and a teiid *(Cnemidophorus)* but otherwise were all iguanids, especially species of *Anolis* (15 insular, 5 mainland), *Leiocephalus* (4 insular) and *Tropidurus* (4 insular, 3 mainland), but also including *Uma* (2) and *Ctenosaura* (1).

For some of these species habits are little known, but a few have been subjects of intensive field study. In an early study of *Anolis sagrei* (FMR 79) in Cuba, Evans (1938) described territoriality and

TABLE 9. Distribution Of FMR Percentages Within Major Subfamilies Of Iguanid Lizards And Colubrid Snakes.

| | Female length as percentage of male length (FMR) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Number of taxa | <80% | 80-89% | 90-99% | 100% | 101-110% | 111-120% | 121-130% | >130% | Total |
| Iguanidae | 226 | 20% | 27.5% | 31% | 1% | 17% | 2.5% | 1% | – | 100% |
| Anolinae | 115 | 26% | 28% | 21% | 2% | 17% | 4% | 2% | – | 100% |
| Iguaninae | 11 | – | 36% | 64% | – | – | – | – | – | 100% |
| Sceloporinae | 62 | 3% | 18% | 50% | – | 23% | 6% | – | – | 100% |
| Tropidurinae | 33 | 33% | 42% | 18% | – | – | 3% | – | – | 100% |
| Colubridae | 214 | – | 7.5% | 14% | 3% | 19.5% | 22.5% | 14% | 12.5% | 100% |
| Alsophiinae | 14 | – | 7% | 14% | – | 14% | 29% | 7% | 29% | 100% |
| Colubrinae | 36 | 8% | 14% | 33% | 8% | 33% | – | 3% | – | 100% |
| Dipsadinae | 20 | – | – | 20% | – | 20% | 25% | 25% | 10% | 100% |
| Lampropeltinae | 13 | 8% | 38% | 38% | – | 8% | 8% | – | – | 100% |
| Natricinae | 66 | – | – | – | – | 18% | 35% | 20% | 27% | 100% |

male fighting. He found a social system in which dominant adult males maintained large territories supporting various other categories of individuals including juveniles, breeding females, and subordinate males. Michael (1972) studied the ecology of *Anolis carolinensis* (FMR 79) in eastern Texas. He found that most females begin to ovulate in the season following their own hatching. Although males attain sexual maturity early, when they are less than a year old, still relatively small, and lacking full development of their secondary sexual characters, nearly all matings involve the relatively few large and dominant males that are at least 36 months old and 60 mm S-V. In *Cnemidophorus lemniscatus* (FMR 79) males are more brightly colored than females, and are known to be fierce fighters.

*Ctenosaura similis* (FMR 80) also has a polygynous mating system, with large dominant males having relatively large territories which may each include the territories of several females. The latter are mutually exclusive, but the females are less agonistic than males. Immature or subordinate adults may have territories within those of other individuals. *Ctenosaura* is an exception to the rule that most reptiles that have relatively small females have small egg clutches (e.g., only one egg in *Anolis*). A large female ctenosaur may lay more than 80 eggs; average clutch was found to be 43 (Fitch and Henderson, 1978).

The snakes that have exceptionally low FMRs are rattlesnakes, and colubrids of two subfamilies. The spectacular combat dance of the rattlesnakes is well known. Many of the field observations of it pertain to *Crotalus mitchelli* and *C. viridis*, the two species having the lowest FMR (78 in both *C. m. pyrrhus* and *C. v. nuntius*). The existence of male combat in *Drymoluber dichrous* (FMR 74) and *Psammophis*

TABLE 10. Mean Female to Male Ratios (FMR) For Species In Various Genera Of Lizards And Snakes.

| Genus | Number of taxa | Mean FMR | σm | Range |
|---|---|---|---|---|
| *Anolis* | 106 | 89.21 | ±1.17 | ( 68-125) |
| *Cnemidophorus* | 12 | 93.08 | ±1.79 | ( 79-104) |
| *Crotalus* | 25 | 87.60 | ±1.19 | ( 78-103) |
| *Elaphe* | 9 | 99.00 | ±2.24 | ( 86-108) |
| *Eumeces* | 14 | 99.93 | ±1.11 | ( 90-106) |
| *Lacerta* | 22 | 96.27 | ±1.97 | ( 82-116) |
| *Lampropeltis* | 9 | 93.10 | ±2.64 | ( 87-112) |
| *Leiocephalus* | 11 | 78.36 | ±2.12 | ( 66- 89) |
| *Mabuya* | 16 | 101.56 | ±2.42 | ( 87-120) |
| *Nerodia* | 17 | 125.11 | ±3.81 | (107-162) |
| *Phyllodactylus* | 12 | 101.25 | ±1.48 | ( 95-115) |
| *Sceloporus* | 49 | 97.96 | ±1.23 | ( 81-112) |
| *Sphaerodactylus* | 7 | 107.00 | ±1.90 | ( 99-113) |
| *Thamnophis* | 20 | 122.30 | ±2.50 | (106-146) |
| *Tropidurus* | 16 | 84.38 | ±2.52 | ( 71-116) |

TABLE 11. Distribution Of FMR Percentages Within Various Genera Of Snakes And Lizards.

| | | Female length as percentage of male length (FMR) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Number of taxa | <80% | 80-89% | 90-99% | 100% | 101-110% | 111-120% | 121-130% | >130% | Total |
| *Anolis* | 106 | 28% | 29% | 21% | 1% | 18% | 1% | 1% | – | 100% |
| *Cnemidophorus* | 12 | 4% | 4% | 67% | – | 25% | – | – | – | 100% |
| *Crotalus* | 25 | 8% | 54% | 33% | – | 4% | – | – | – | 100% |
| *Eumeces* | 14 | – | – | 43% | – | 57% | – | – | – | 100% |
| *Lacerta* | 22 | – | 24% | 41% | 4% | 24% | 9% | – | – | 100% |
| *Leiocephalus* | 14 | 36% | 36% | 28% | – | – | – | – | – | 100% |
| *Mabuya* | 16 | – | 19% | 19% | – | 43% | 19% | – | – | 100% |
| *Nerodia* | 17 | – | – | – | – | 18% | 29% | 18% | 35% | 100% |
| *Phyllodactylus* | 12 | – | – | 31% | 23% | 38% | 8% | – | – | 100% |
| *Sceloporus* | 49 | – | 17% | 48% | – | 27% | 8% | – | – | 100% |
| *Thamnophis* | 20 | – | – | – | – | 20% | 25% | 30% | 25% | 100% |
| *Tropidurus* | 16 | 38% | 50% | 6% | – | – | 6% | – | – | 100% |

*schokari* (FMR 79) may be suspected. Social interactions between snakes are much less often observed than those of lizards. Aggressive behavior has been reported in relatively few kinds but perhaps occurs in many others. Presumably those males that are most aggressive and most successful in vanquishing rivals in the combat dance are also most successful in mating, but this relationship has not actually been demonstrated in field studies.

The possibility of males siring offspring by forcible mating may have led to selection for larger size in the male. Even a small difference in size between the sexes with the male larger and stronger, might greatly increase the possibility of rape. In a species having the female larger, she would tend to dominate and intimidate the male; he could not overpower her and rape would scarcely be possible. Thornhill (1980) has developed the theory that large male size has evolved in many species, including humans, to make rape possible. He rejected the idea that sexual dimorphism in humans was related to an evolutionary history in which the prevalent mating system was harem polygyny, but ". . . regardless of the prevalent mating system in human evolutionary history, larger males were favored because of the increased likelihood of successful rape if they failed to compete successfully for parental resources."

In both snakes and turtles the highly altered body form renders copulation difficult, and even though the male succeeded in overpowering the female, he might not be able to accomplish intromission. In both groups female cooperation seems essential for consummation of courtship to occur. A female tortoise may frustrate the male's attempts merely by resting her shell on the substrate instead of standing, and a female snake must raise her tail causing the cloaca to gape for the male's hemipenis to be inserted. In contrast, lizards accomplish copulation much more readily. Seemingly forcible copulations, including homosexual matings with subordinate or defeated males, are fairly common. It may be significant in this connection that the male is the larger in the majority of lizard species, whereas the reverse is true in the majority of snakes and turtles.

Predation may be an important inhibition to the development of male combat and the evolution of relatively large males. In discussing sexual size differences in amphibians, Shine (1979) wrote that

> . . . a major factor in the evolution of male combat may be the participant's vulnerability to predation. Fighting frogs are exposed to predators . . . and one might expect combat to be most common in species that are at little risk. Risk should be lowest in species with large body size or chemical defenses . . . .

Presumably the same factors affect sexual size ratios in reptiles. In snakes, especially, male fighting and relatively large male size are characteristic of formidably venomous kinds—rattlesnakes and their near relatives, and the Australian oxyuranines. Although none of these snakes is free from predation, they are certainly much less vulnerable than non-venomous types, and hence can indulge in fighting with reasonably low risk of predation. Male fighting and relatively large male size is also conspicuous in the crocodilians, giant reptiles which as adults are generally secure from predation.

In lizards, on the contrary, male fighting and relatively large male size is common and occurs mostly in kinds that are not large or formidable and lack noxious qualities—lacertids, teiids and iguanids (especially anolines and tropidurines) that are highly vulnerable to predation. A common trait of these species is that they are active, agile and swift. A combat or chase may be almost instantaneous, and exposure to predation is thereby minimized for any single encounter. Likewise, in snakes, several of

those that have relatively large males and are known or presumed to have male combat are relatively innocuous but fast-moving kinds, *Coluber* and *Psammophis*.

A group of 120 species (87 lizards, 31 snakes, 2 turtles) were found to have FMRs in the range 81-90, that is, with males substantially larger than females. In this group, 60 were iguanids in 10 genera, but *Anolis* was by far the best represented, with 33 species. Other lizards were geckonids (2 genera), agamids (1 genus), teiids (4 genera), lacertids (3 genera) and skinks (3 genera). The 31 snakes belonged to 13 genera of colubrids, elapids and crotalids; *Crotalus* with 13 species and *Lampropeltis* with 4 species were the best represented.

At the upper end of the scale, with FMRs exceeding 130, that is with females very large, are 37 species of snakes and 20 turtles (Fig. 5). All the turtles are emydids and trionychids. Species of the genera *Graptemys* and *Trionyx* were found to have FMRs much higher than in any other reptils. The snakes include a boid, 2 typhlopids, 17 natricines, 4 alsophiines, 7 other miscellaneous colubrids, 2 oxyuranines and 2 crotalids.

The group with somewhat smaller FMRs, in the range 121 to 130, was found to include 30 snakes and only 2 lizards, the latter both rainforest iguanids, *Anolis vittigerus* and *Polychrus marmoratus*. The snakes included a boid, a typhlopid, a viperid, 2 oxyuranines, 12 natricines, 4 dipsadines, and 9 other miscellaneous colubrids. In the FMR range 111 to 120 were found 26 species of lizards of eight families, *Ablepharus* (2), *Anolis, Chamaeleo, Coleonyx, Gambelia, Ichnotropis, Lacerta* (2), *Lipinia, Mabuya* (3), *Moloch, Ophiomorus* (2), *Phyllodac-*

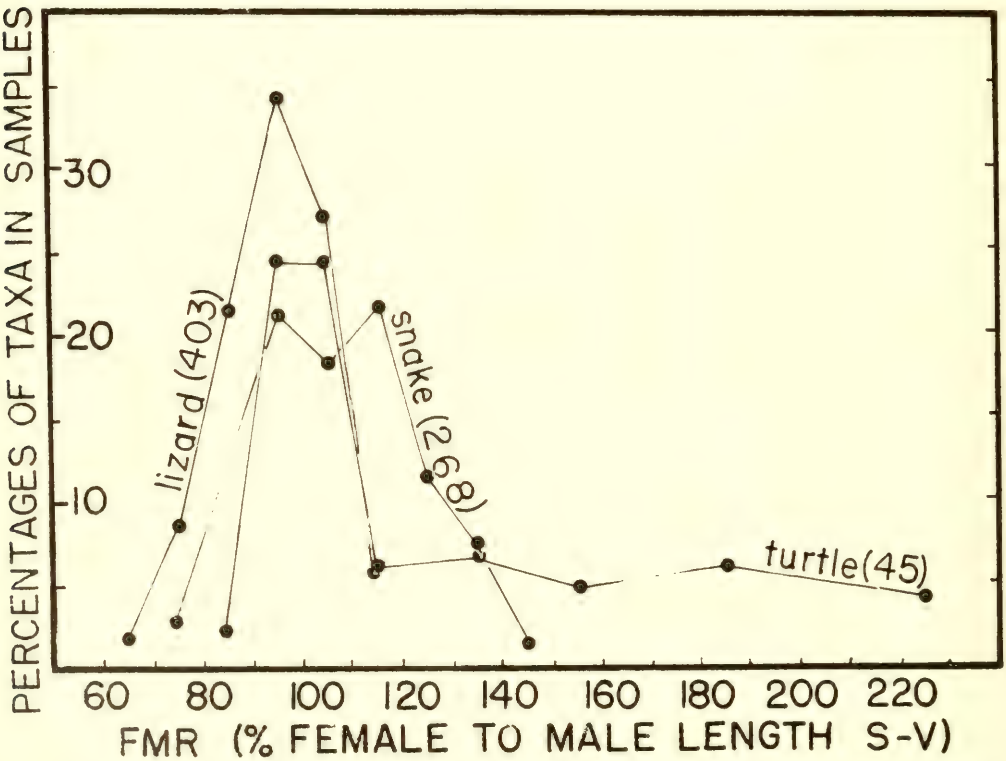


FIG. 5. Comparison of FMR in turtles, lizards and snakes. Each group has a wide range of FMR but trends differ with turtles attaining much higher ratios than squamates, and snakes attaining much higher ratios than lizards.

*tylus, Ptychodactylus, Sceloporus* (4), *Sphaerodactylus* (2), *Tropidurus, Xantusia,* and 63 other species of snakes of 42 genera.

More than half of the reptile taxa studied had FMRs in the range 91 to 110, that is with small or moderate size difference between the sexes, but only about 3.2 percent of the total 770 lacked SSD. Regardless of which sex is larger, the lizards and turtles in this range usually have male rivalry and combat. In the snakes, on the contrary, combat is known to occur mostly in those kinds having males definitely larger than females.

Significant trends in the correlation of FMRs with other specific traits are discernible in a few instances. Other such correlations are suspected but are still not demonstrable. In general, relatively large female size is demonstrably correlated with: (1) viviparous (vs. oviparous) reproduction, (2) large (vs. small) mean number of offspring in clutch or litter, (3) temperate (vs. tropical) climate where the species occurs, and (4) small (vs. large) body size. All these factors are interrelated. There are many species that are exceptions to the general trends.

According to Trivers' (1972) theory, intrasexual competition is closely linked with parental investment. Whichever sex (usually the female) devotes the most energy, risk and sacrifice to the offspring will be in short supply, and will be the object of competition by the opposite sex. Intrasexual competition will select for size, strength and aggressiveness, and the most successful competitors will have many mates and disproportionately large numbers of offspring.

Figure 6 demonstrates the trend from few eggs or young per clutch or litter in species having relatively small females to much larger broods in those species having relatively large females. Anoles and geckos make up a high proportion of the small-brooded species in this particular sample, whereas many of the large-brooded species are natricine snakes. Striking exceptions to the general trends are seen in *Ctenosaura similis* and *Iguana iguana*, which have relatively small females, yet these produce large clutches, with more eggs than other lizards and more than most snakes.

Figure 7 demonstrates the trend in squamate reptiles from a low incidence of viviparity in those species having relatively small females to a high incidence of viviparity in those having relatively small males. Viviparous species are committed to a strategy of relatively long intervals between broods during gestation, compensated by moderate or large numbers of young per brood. As a container and carrier of the eggs and embryos, the female is subject to selective pressure to attain adequately large size.

Figure 8 demonstrates the related trend in squamates from a high percentage of tropical species among those with relatively large males to a minority of tropical species (i.e., mostly temperate zone species) among those with relatively large females. The most plausible explanation of this trend is that tropical species, having continuous breeding in some instances, or at least having an extended breeding season, are under less selective pressure to increase their size as egg containers than are those more restricted to a short and concentrated breeding season in the temperate zone.

Figure 9 shows mean sexual size ratios in lizards and snakes of various body-size groups. The main trend seems to be from larger mean size in the groups of species having relatively large males to smaller mean size in the groups of species having relatively large females. However, some points on the graph deviate from the general trend. Also each FMR grouping includes species over a wide size-range, and the correlation between FMR and body size is not statistically significant.

Both Ralls (1976) and Kolata (1977) after examining the evidence, mainly in mammals and birds, concluded that no one of the current theories could satis-

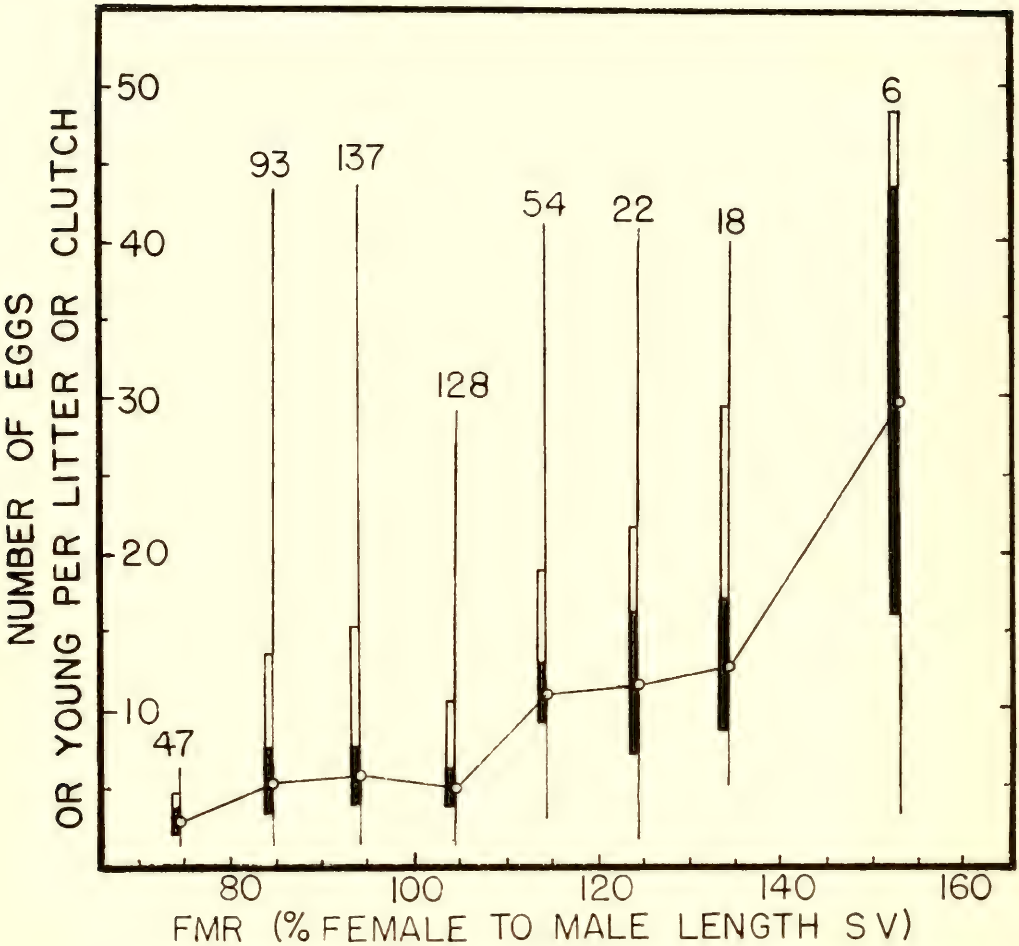


FIG. 6. Correlation of mean number of offspring per brood with FMR in 505 taxa of squamate reptiles showing trend from few young in kinds having relatively large males to many young in kinds having relatively large females. For each sample, mean, range, standard deviation, and two standard errors on each side of the mean are shown. Major sources of information on brood size were: Fitch 1970, Kopstein 1941, Pope 1935, and Wright and Wright 1957, but many others also were utilized. For some of the taxa that were included, only one record of a brood was available.

factorily explain all instances in which sexual size differences exist as each case is somewhat different, and the important effects of ecological and physiological factors have to be taken into account. The records herewith accumulated for reptiles certainly support the supposition that the sources of sexual size differences are complex and varied.

Freshwater turtles have progressed farthest in evolving disparate sizes in the sexes, with females commonly 1.4 to 1.8 times the linear dimensions of males and 3 to 6 times their bulk (*Deirochelys, Graptemys, Pseudemys, Chrysemys* and *Trionyx*). In all of these, time to maturity is accelerated in males as compared with females. Usually the male's development from hatching to sexual maturity occurs in from 50 to 60 percent of the time required by the female. The result should be an excess of males, and the production of females so large and bulky that they are relatively safe from natural enemies and are able to utilize certain food resources

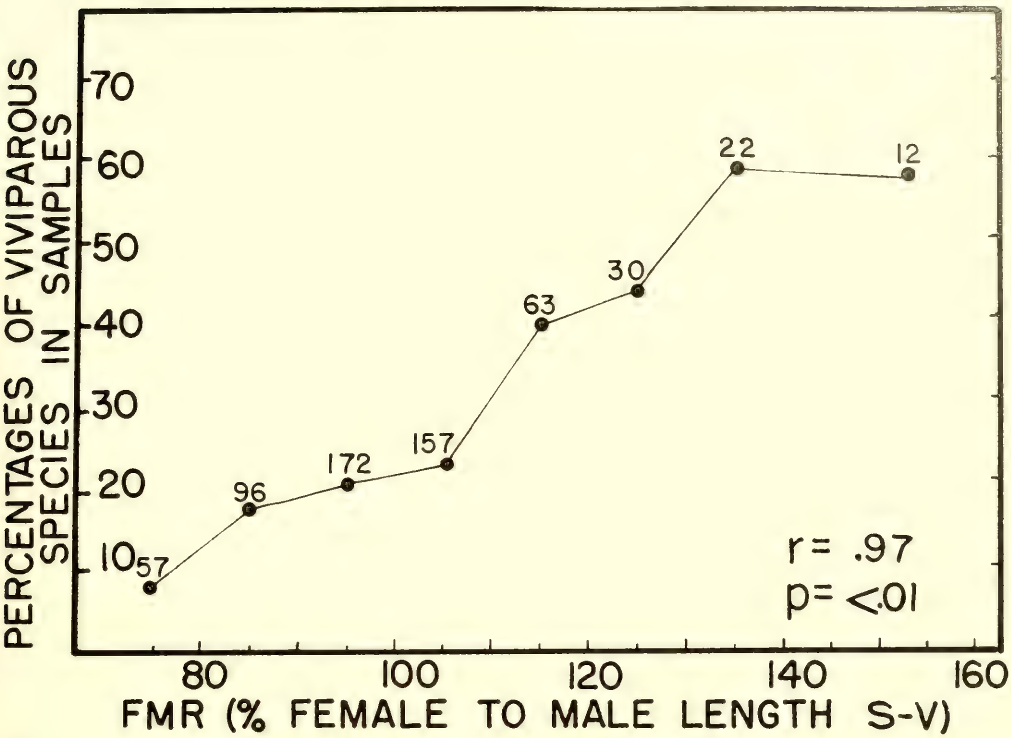


FIG. 7. Correlation of oviparity with relatively large male size vs viviparity with relatively large female size in 609 species of squamate reptiles.

not available to the males. Sex ratios of several of these species approximated 1:1 in field samples (Bury, 1979). In a recent study of *Graptemys geographica* at Lake of Two Mountains, Quebec, Gordon and MacCullock (1979) found the population to be biased in favor of males. On the contrary, Seigel (1979) found that in a population of *Malaclemys terrapin* in Brevard County, Florida, females outnumber males by as much as 5 to 1.

Bull and Vogt (1979) found that in *Graptemys*, sex is controlled by environmental temperature during the middle third of the incubation period. Clutches kept at 25° C in the laboratory produced nearly all male hatchlings, whereas clutches kept at 30.5° produced almost all females. Natural nests that were monitored likewise produced biased sex ratios in hatchlings, depending whether the site was warm and sunny (females predominant) or cool and shaded (males predominant).

Regardless of which sex is the larger, SSD relieves intraspecific competition by partitioning food resources. Anoles are typical of reptiles having relatively large males, and for this genus Schoener (1967) and others have amply demonstrated that males, on the average, take larger food items often of different taxa from those taken by females. Also, in anoles the sexes may occupy somewhat different habitat niches; in species having tree-trunk to ground orientation, males usually perch higher.

At the opposite end of the scale, in species with relatively large females, reproductive success is promoted by the fact that reproductive females are relieved from competition by immatures as well as by males. In a study of Kansas *Thamnophis sirtalis* (FMR 123), I found incomplete partitioning of food resources which may be typical of snakes having SSD in this range. Average weight of females was 155 per cent of male

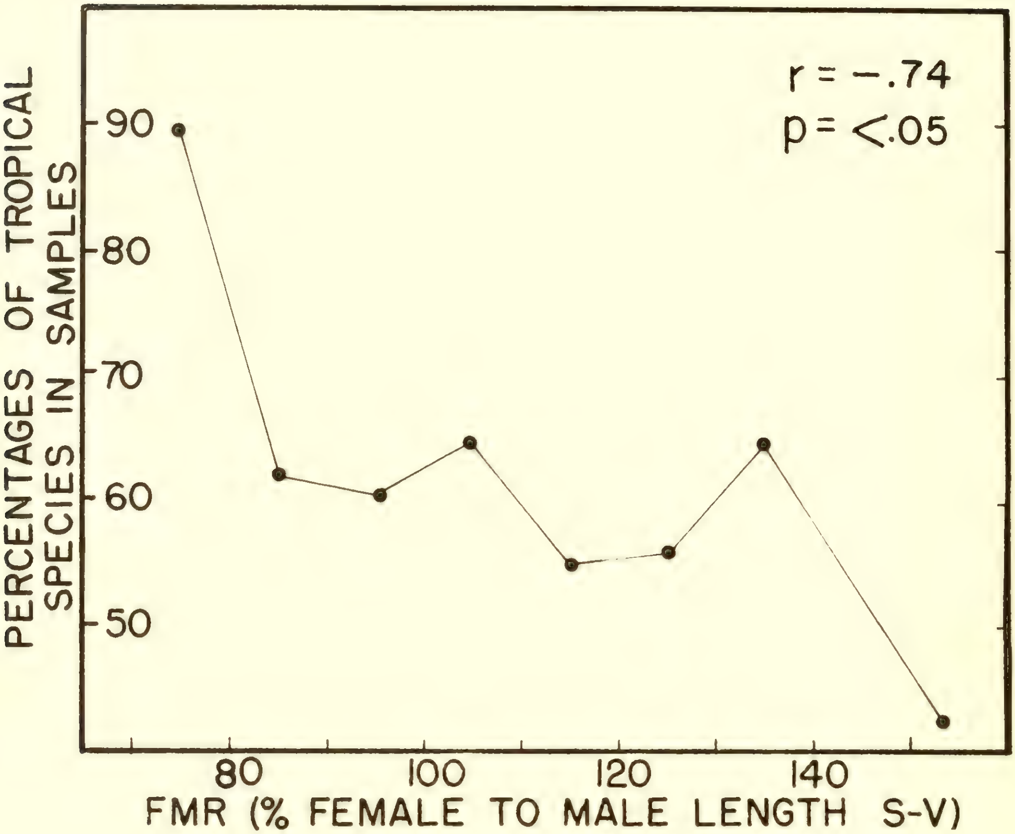


FIG. 8. Correlation between SSD and climate in squamate reptiles; a trend is evident, with a high percentage of species having relatively large males in tropical climates, and a high percentage having relatively large females in temperate-zone climates.

weight and females took larger food objects, especially mammals. Voles (*Microtus ochrogaster*) and wood mice (*Peromyscus leucopus*) were found to be the mainstay of the female diet, but both of these abundant small rodents are beyond the capacity of most males, which prey chiefly upon frogs. On the same area incomplete partitioning of food resources was found in *Coluber constrictor* (FMR 110). The large females were found to take voles and mice more often than did males, which tended to be more arboreal and had a higher component of insect prey.

*Graptemys pulchra* provides the most extreme case of SSD with the female averaging more than 15 times the male's bulk, and requiring 3 to 4 times as long to attain sexual maturity. Sexual dimorphism is correlated with food habits, the adult female being specialized for mollusk-eating, with powerful jaws adapted for crushing shells, whereas the male, a more typical emydid in appearance, feeds to a large extent on soft-bodied insects (Ernst and Barbour, 1972).

Reptiles have not evolved such extreme SSD as some other groups of animals. The deep sea ceratioid angler fishes for instance have carried reduction of male size much further; the diminutive males attach permanently to the female and derive sustenance from her in a relationship that has been described as sexual parasitism (Bertelsen, 1951). The tiny males of some argiopid spiders which live like commensals in the webs

of their much larger mates, provide examples of another type of dependence on the female, leading to extreme reduction in male size (Gertsch, 1949).

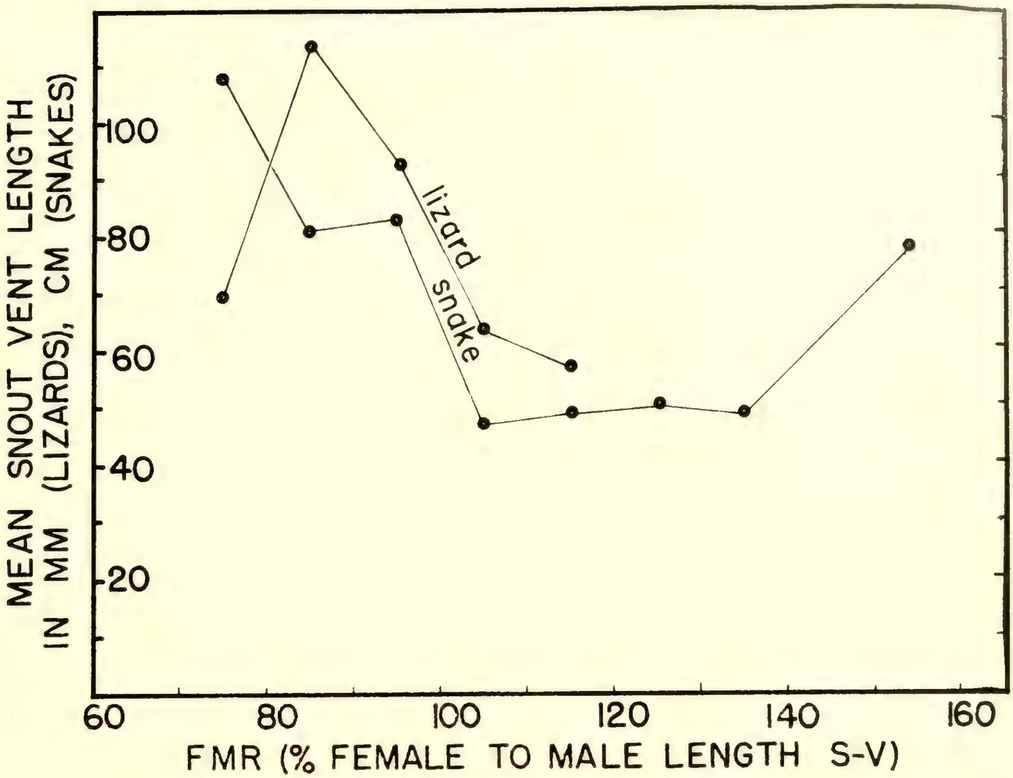


FIG. 9. Average adult size in lizards and snakes correlated with SSD showing that in both groups SSD (especially with male superiority) tends to be greater in species of large body size and less in small species.

## LITERATURE CITED


Abalos, J. W., E. C. Baez and R. Nader. 1965. Serpientes de Santiago de Estero. Acta Zoologica Lilloana 20:211-283.

Achaval, F. 1973. El genero *Clelia* en el Uruguay. Trab. V. Congr. Latinoam. Zool. 1:17-29.

Alcala, A. C. and W. C. Brown. 1967. Population ecology of the tropical scincoid lizard, *Emoia atrocostata,* in the Philippines. Copeia 1967(3):596-604.

Amadon, D. 1959. The significance of sexual difference in size among birds. Proc. Amer. Phil. Soc. 103:531-546.

Anderson, S. C. 1963. Amphibians and reptiles from Iran. Proc. California Acad. Sci. 31(16):417-498.

Anderson, S. C. and A. E. Leviton. 1966a. A review of the genus *Ophiomorus* (Sauria: Scincidae), with descriptions of three new forms. Proc. California Acad. Sci. 4th ser. 33(16):499-534.

———. 1966b. A new species of *Eublepharis* from southwestern Iran (Reptilia: Gekkonidae). Occas. Papers California Acad. Sci. No. 53, 5 pp.

Arnold, E. N. and A. E. Leviton. 1977. A revision of the lizard genus *Scincus* (Reptilia: Scincidae). Bull. British Mus. (Nat. Hist.) 31(5):189-248.

Auffenberg, W. 1978. Courtship and breeding behavior in *Geochelone radiata* (Testudines: Testudinidae). Herpetologica 34(3): 277-287.

Bailey, J. R. 1938. A systematic revision of the snakes of the genus *Coniophanes.* Papers Michigan Acad. Sci. Art and Letters 24, pt. 2:1-48.

Barbault, R. 1974. Structure et dynamique des populations naturelles de lezard *Mabuya buettneri* dans la savane de lamto (Cote d'Ivoire). Bull. d'Ec. 5(2):105-121.

Barker, D. G., J. B. Murphy and K. W. Smith. 1979. Social behavior in a captive group of Indian pythons, *Python molurus* (Serpentes, Boidae) with formation of a linear social hierarchy. Copeia 1979(3):466-471.

Beebe, W. 1944. Field notes on the lizards of Kartabo, British Guiana, and Caripito, Venezuela. Part 2. Iguanidae. Zoologica 29(4): 195-216.

Bertelsen, E. 1951. The ceratioid fishes. Dana Report 39:1-281.

Blanchard, F. N. 1921. A revision of the king snakes: genus *Lampropeltis.* U.S. Nat. Mus. Bull. 114, 260 pp.

———. 1937. Data on the natural history of the red-bellied snake, *Storeria occipitomaculata* (Storer), in northern Michigan. Copeia 1937:151-162.

Bogert, C. M. 1939. Notes on snakes of the genus *Salvadora* with a redescription of a neglected Mexican species. Copeia 1939: 140-147.

Bogert, C. M. and V. D. Roth. 1966. Ritualistic combat of male gopher snakes, *Pituophis melanoleucus affinis* (Reptilia, Colubridae). Am. Mus. Nat. Hist. Novit. no. 2245, 27 pp.

Bons, J. and H. St. Girons. 1963. Ecologie et cycle sexuel des amphisbeniens du Maroc. Bull. Soc. Sci. et Physiquees du Maroc. 3e et 4e trimestre:117-176.

Booth, J. and J. A. Peters. 1972. Behavioral studies on the green turtle *(Chelonia mydas)* in the sea. Anim. Behav. 20:808-812.

Bostic, D. L. 1966. A preliminary report of reproduction in the teiid lizard, *Cnemidophorus hyperythrus beldingi.* Herpetologica 22(2):81-90.

Brain, C. K. 1969. Field observations on lizards (Scincidae: *Mabuya*). Koedoe no. 12:1-10.

Brazaitis, P. 1973. The identification of living crocodilians. Zoologica 58(3-4):59-101.

Breckenridge, W. J. 1955. Observations on the life history of the soft-shelled turtle, *Trionyx ferox,* with especial reference to growth. Copeia 1955(1):5-9.

Broadley, D. G. and E. V. Cock. 1975. Snakes of Rhodesia. Longman Rhodesia Ltd., Salisbury. 152 pp.

Brown, W. C. and D. S. Rabor. 1967. Review of the genus *Brachymeles* (Scincidae) with descriptions of new species and subspecies. Proc. California Acad. Sci. 34(15):525-548.

Brown, W. S. 1971. Morphometrics of *Terrapene coahuila* (Chelonia, Emydidae), with comments on its evolutionary status. Southwestern Nat. 16(2):171-184.

Bruno, S. 1967a. La *Vipera ursinii* (Bonaparte 1835) in Italia. Ricerche Sulla Fauna Appenninica. Memorie del Museo Civico di Storia Naturale, Verona, 15:105-125.

———. 1967b. Sulla *Vipera ammodytes* (Linnaeus 1758) in Italia. Memorie del Museo Civico di Storia Naturale, Verona, 15: 289-336.

———. 1968. Gli anfibi e i rettili dell'Isola di Montecristo. Atti della Societá Toscana di Scienze Naturale Memorie 75(B):31-71.

———. 1969. Morfologia, distribuzione e biologia di *Elaphe situla* (Linnaeus) 1758 (Reptilia, Serpentes, Colubridae). Atti della Accademia Gioenia di Scienze Naturali in Catania Serie Settima 1:1-44.

———. 1970. Anfibi e rettili di Sicilia. Atti della Accademia Gioenia di Scienze Naturali in Catania Serie Settima 2:1-144.

Bull, J. and R. C. Vogt. 1979. Temperature-dependent sex determination in turtles. Science 206:1186-1188.

Burkett, R. D. 1966. Natural history of the

cottonmouth moccasin, *Agkistrodon piscivorus* (Reptilia). Univ. Kansas Publ. Mus. Nat. Hist. 17(9):435-491.

Burkholder, G. L. and J. M. Walker. 1973. Habitat and reproduction of the desert whiptail lizard *Cnemidophorus tigris* in the northern part of its range. Herpetologica 29(1):76-83.

Burrage, B. R. 1973. Comparative ecology and behaviour of *Chamaeleo pumilus pumilus* (Gmelin) and *C. namaquensis* A. Smith (Sauria: Chamaeleonidae). Ann. S. African Mus. 61:1-158.

Bury, R. B. 1979. Population ecology of freshwater turtles. Pp. 571-602 *in* Turtles, Perspectives and Research. Harless, M. and H. Morlock. John Wiley and Sons, N.Y. 695 pp.

Bustard, R. H. 1964. The systematic status of the Australian geckos *Gehyra variegata* (Duméril and Bibron, 1836) and *Gehyra australis* Gray 1845. Herpetologica 29(4): 259-272.

———. 1968. The ecology of the Australian gecko *Heteronotia binoei* in northern New South Wales. Jour. Zool., Proc. Zool. Soc. London 156(4):483-497.

Cagle, F. R. 1954. Observations on the life cycles of painted turtles (genus *Chrysemys*). Amer. Midl. Nat. 52:225-235.

Campbell, J. A. and B. L. Armstrong. 1979. Geographic variation in the Mexican pygmy rattlesnake, *Sistrurus ravus*, with the description of a new subspecies. Herpetologica 35(4):304-317.

Carey, W. M. 1975. The rock iguana, *Cyclura pinguis*, on Anageda, British Virgin Islands. Bull. Florida State Mus. 19(4):189-233.

Carpenter, C. C. 1952. Growth and maturity of the three species of *Thamnophis* in Michigan. Copeia 1952(4):237-243.

———. 1969. Behavioral and ecological notes on the Galapagos land iguanas. Herpetologica 25(3):155-164.

———. 1970. Miscellaneous notes on Galapagos lava lizards (Tropidurus—Iguanidae). Herpetologica 26(3):377-386.

Carpenter, C. C., J. B. Murphy and L. A. Mitchell. 1978. Combat bouts with spur use in the Madagascan boa *(Sanzinia madagascarensis)*. Herpetologica 34:207-212.

Carr, A. E. 1952. Handbook of turtles. Comstock Publ. Assoc. Cornell Univ. Press, Ithaca. 542 + xv pp.

Cei, J. M. 1975. Southern Patagonian lizards of the *Liolaemus kingi* Group. Herpetologica 31(1):109-116.

———. 1979. Remarks on the South American iguanid lizard *Liolaemus anomalus* Koslowsky and the synonymy of *Phrynosaura werneri* Müller (Reptilia, Lacertilia, Iguanidae). Jour. Herp. 13(2):183-186.

Chabreck, R. H. and T. Joanen. 1979. Growth rate of American alligators in Louisiana. Herpetologica 35(1):51-57.

Christiansen, J. L. and R. R. Burken. 1979. Growth and maturity of the snapping turtle *(Chelydra serpentina)* in Iowa. Herpetologica 35(3):261-266.

Christiansen, J. L. and E. O. Moll. 1973. Latitudinal reproductive variation within a single subspecies of painted turtle *Chryseyms picta belli*. Herpetologica 29:152-163.

Church, G. 1962. The reproductive cycle of the Javanese house geckos, *Cosymbotus platurus, Hemidactylus frenatus* and *Peropus mutilatus*. Copeia 1962(2):262-269.

Clark, D. R., Jr. 1964. Reproduction and sexual dimorphism in a population of the rough earth snake, *Virginia striatula* (Linnaeus). Texas Jour. Sci. 16(3):265-295.

Conant, R. 1969. A review of the water snakes of the genus *Natrix* in Mexico. Bull. American Mus. Nat. Hist. 142(1):140 pp.

Corn, M. J. and P. L. Dalby. 1973. Systematics of the anoles of San Andrés and Providencia Islands, Colombia. Jour. Herp. 7(2):63-74.

Cott, H. B. 1961. Scientific results of an inquiry into the ecology and economic status of the Nile crocodile *(Crocodylus niloticus)* in Uganda and northern Rhodesia. Trans. Zool. Soc. London 29(4):210-357.

De Haas, C. P. J. 1941. Some notes on the biology of snakes and on their distribution in two districts in West Java. Treubia 18 (2):327-375.

Dixon, J. R. 1974. Systematic review of the microteiid genus *Iphisa*. Herpetologica 30 (2):133-139.

Dixon, J. R. and R. B. Huey. 1970. Systematics of the lizards of the gekkonid genus *Phyllodactylus* of mainland South America. Los Angeles County Museum Contrib. Sci. no. 192, 78 pp.

Dixon, J. R. and P. Soini. 1975. The reptiles of the upper Amazon Basin, Iquitos Region, Peru. I. Lizards and Amphisbaenians. Milwaukee Pub. Mus. Contrib. Biol. and Geol. no. 4, 58 pp.

———. 1977. The reptiles of the upper Amazon Basin, Iquitos Region, Peru. II. Crocodilians, Turtles and Snakes. Milwaukee Pub. Mus. Contrib. Biol. and Geol. no. 12, 91 pp.

Dixon, J. R. and J. W. Wright. 1975. A review of the iguanid genus *Tropidurus* in Peru. Los Angeles Co. Mus. Contrib. Sci. no. 271, 39 pp.

Dmi'el, R. 1967. Studies on reproduction and growth and feeding in the snake *Spalerosophis cliffordi* (Colubridae). Copeia 1967 (2):332-346.

Dobie, J. L. 1971. Reproduction and growth in the alligator snapping turtle. Copeia 1971:645-658.

Donoso-Barros, R. 1966. Reptiles de Chile.

Edición de la Universidad de Chile, Santiago. 458 pp.

Dowling, H. G. 1950. Studies of the black swamp snake, *Seminatrix pygaea* (Cope), with descriptions of two new subspecies. Misc. Publ. Mus. Zool. Univ. Michigan 76, 38 pp.

Downs, F. L. 1967. Intrageneric relationships among colubrid snakes of the genus *Geophis* Wagler. Misc. Publ. Mus. Zool. Univ. Michigan no. 131, 193 pp.

Duellman, W. E. 1958. A monographic study of the colubrid snake genus *Leptodeira*. Bull. Amer. Mus. Nat. Hist. 114, art. 1, 152 pp.

———. 1960. Variation, distribution and ecology of the Mexican teiid lizard *Cnemidophorus calidipes*. Copeia 1960(2):97-101.

———. 1978. The biology of an equatorial herpetofauna. Univ. Kansas Mus. Nat. Hist. Misc. Publ. no. 65, 352 pp.

Duellman, W. E. and A. Schwartz. 1958. Amphibians and reptiles of southern Florida. Bull. Florida St. Mus., Biol. Sci. 3(5): 181-324.

Duellman, W. E. and J. Wellman. 1960. A systematic study of lizards of the *Deppei* group (genus *Cnemidophorus*) in Mexico and Guatemala. Misc. Publ. Zool. Univ. Michigan no. 111, 81 pp.

Dunham, A. E., D. W. Tinkle and J. W. Gibbons. 1978. Body size in island lizards: a cautionary tale. Ecology 59(6):1230-1238.

Echternacht, A. C. 1971. Middle American lizards of the genus *Ameiva* (Teiidae) with emphasis on geographic variation. Univ. Kansas Mus. Nat. Hist. Misc. Publ. 55, 86 pp.

———. 1973. The color pattern of *Sonora michoacanensis* (Dugès) (Serpentes, Colubridae) and its bearing on the species. Breviora, Mus. Comp. Zool. no. 410, 18 pp.

Ernst, C. H. 1971. Growth of the painted turtle, *Chrysemys picta*, in southeastern Pennsylvania. Herpetologica 27:135-141.

———. 1977. Biological notes on the bog turtle, *Clemmys muhlenbergii*. Herpetologica 33(2):241-246.

———. 1978. A revision of the neotropical turtle genus *Callopsis* (Testudines: Emydidae: Batagurinae). Herpetologica 34(2): 113-134.

Ernst, C. H. and R. W. Barbour. 1972. Turtles of the United States. University Press of Kentucky, Lexington. 347 pp.

Etheridge, R. 1964. The skeletal morphology and systematic relationships of sceloporine lizards. Copeia 1964(4):610-631.

———. 1965. The abdominal skeleton of lizards in the family Iguanidae. Herpetologica 21(3):161-168.

———. 1966. The systematic relationships of West Indian and South American lizards referred to the iguanid genus *Leiocephalus*. Copeia 1966(1):79-91.

———. 1968. A review of the iguanid lizard genera *Uracentron* and *Strobilurus*. Bull. British Mus. (Nat. Hist.) 17(2):47-64.

———. 1969. A review of the iguanid lizard genus *Enyalius*. Bull. British Mus. (Nat. Hist.) 18(8):233-260.

———. 1970. A review of the South American iguanid lizard genus *Plica*. Bull. British Mus. (Nat. Hist.) 19(7):237-256.

Evans, L. T. 1938. Cuban field studies on territoriality of the lizard, *Anolis sagrei*. Jour. Comp. Psychol. 25:97-125.

Fitch, H. S. 1940. A biogeographical study of the ordinoides artenkreis of garter snakes (genus *Thamnophis*). Univ. California Publ. Zool. 44(1):1-150.

———. 1960. Autecology of the copperhead. Univ. Kansas Publ. Mus. Nat. Hist. 13(4): 85-288.

———. 1963. Natural history of the racer, *Coluber constrictor*. Univ. Kansas Publ. Mus. Nat. Hist. 15(8):351-468.

———. 1965. An ecological study of the garter snake *Thamnophis sirtalis*. Univ. Kansas Publ. Mus. Nat. Hist. 15(10): 493-564.

———. 1970. Reproductive cycles of lizards and snakes. Univ. Kansas Mus. Nat. Hist. Misc. Publ. no. 52, 247 pp.

———. 1975. A demographic study of the ringneck snake (*Diadophis punctatus*) in Kansas. Univ. Kansas Mus. Nat. Hist. Misc. Publ. No. 62:1-53.

———. 1976. Sexual size differences in the mainland anoles. Occas. Papers Mus. Nat. Hist. Univ. Kansas 50:1-21.

———. 1978. Sexual size differences in the genus *Sceloporus*. Univ. Kansas Sci. Bull. 51(13):441-461.

Fitch, H. S. and R. W. Henderson. 1977. Age and sex differences, reproduction and conservation of *Iguana iguana*. Contrib. Biol. and Geol. Milwaukee Pub. Mus. 13: 1-21.

———. 1978. Ecology and Exploitation of *Ctenosaura similis*. Univ. Kansas Sci. Bull. 51(15):483-500.

FitzSimons, V. F. M. 1930. Scientific results of the Vernay-Lang Kalahari expedition, March to September, 1930. Ann. Transvaal Mus. 16(2):295-397.

———. 1943. The lizards of South Africa. Transvaal Museum Memoir No. 1, xv + 528 pp.

———. 1962. Snakes of Southern Africa. Purnell and Sons, Ltd., Cape Town. 423 pp.

Force, E. R. 1936. The relation of the knobbed anal keels to age and sex in the lined snake, *Tropidoclonion lineatum* (Hallowell). Papers Michigan Acad. Sci., Arts and Letters, 21:613-617.

FUGLER, C. M. and T. D. SCHWANER. 1968. Sexual dichromatism in the genus *Uracentron*. Herpetologica 24(3):253-255.

FUHN, J. E. and R. MERTENS. 1959. Studien an *Lacerta trilineata* aus Rumänien mit Beschreibung einer neuer Unterart. Senck. biol. 40(1/2):25-42.

FUHN, I. E. and S. VANCEA. 1961. Fauna Republicii Populare Romîne. Reptilia. Editura Academiei Republicii Populare Romine, vol. xiv Fasc. 2, 349 pp.

FUKADA, H. 1964. On the life history of a snake, *Rhabdophis t. tigrinus* (Boie). Acta Herpetologica Japonica, 2(1):1-4.

———. 1965. Breeding habits of some Japanese reptiles (critical review). Bull. Kyoto Gakugei Univ. Series B, no. 27:65-82.

———. 1978. Growth and maturity of the Japanese rat snake, *Elaphe climacophora* (Reptilia, Serpentes, Colubridae). Jour. Herp. 12(3):269-274.

GANS, C. 1964. A redescription of, and geographic variation in, *Liophis miliaris* Linné, the common water snake of southeastern South America. Amer. Mus. Novit. no. 2178:58 pp.

GARRICK, L. D. and J. W. LANG. 1977. Social signals and behaviors of adult alligators and crocodiles. Amer. Zool. 17:225-239.

GARRICK, L. D., J. W. LANG, and H. A. HERZOG, JR. 1978. Social signals of adult American alligators. Bull. American Mus. Nat. Hist. 160(3):153-192.

GARRIDO, O. H. 1972. *Anolis bremeri* Barbour (Lacertilia: Iguanidae) en el occidente de Cuba e Isla de Piños. Carib. Jour. Sci. 12(1-2):59-77.

GERTSCH, W. J. 1949. American Spiders. D. Van Nostrand Co., Inc. New York. xiii + 285 pp.

GIBBONS, J. W. 1967. Variation in growth rates in three populations of the painted turtle, *Chrysemys picta*. Herpetologica 23 (4):296-303.

———. 1968. Population structure and survivorship in the painted turtle, *Chrysemys picta*. Copeia 1968:260-268.

———. 1970. Reproductive characteristics of a Florida population of musk turtles *(Sternothaerus odoratus)*. Herpetologica 26(2): 268-270.

GIBBONS, J. W. and J. W. COKER. 1977. Ecological and life history aspects of the cooter, *Chrysemys floridana* (LeConte). Herpetologica 33(1):29-33.

GIBBONS, J. W., J. W. COKER and T. W. MURPHY, JR. 1977. Selected aspects of the life history of the rainbow snake *(Farancia erytrogramma)*. Herpetologica 33(3):276-281.

GLOYD, H. K. 1972. The Korean snakes of the genus *Agkistrodon* (Crotalidae). Proc. Biol. Soc. Washington 85, no. 49:557-578.

———. 1977. Descriptions of new taxa of crotalid snakes from China and Ceylon (Sri Lanka). Proc. Biol. Soc. Washington 90(4):1002-1015.

GOLDBERG, S. R. and M. D. ROBINSON. 1979. Reproduction in two Namib Desert lacertid lizards (*Aporosaura anchietae* and *Meroles cuneirostris*). Herpetologica 35(2):169-175.

GORDON, D. M. and R. D. MACCULLOCK. 1979. Patterns of movements and habitat utilization in a population of map turtles *(Graptemys geographica)* in southwestern Quebec. Abstracts of papers, 1979 ASIH 59th Annual meeting.

GRAHAM, T. E. 1971. Growth rate of the red-bellied turtle, *Chrysemys rubriventris*, at Plymouth, Massachusetts. Copeia 1971 (2):353-356.

GRAHAM, T. E. and T. S. DOYLE. 1979. Dimorphism, courtship, eggs and hatchlings of the Blanding's turtle, *Emydoidea blandingii* (Reptilia, Testudines, Emydidae) in Massachusetts. Jour. Herp. 13(1):125-127.

GYI, K. 1970. A revision of the Colubrid snakes of the subfamily Homalopsinae. Univ. Kansas Publ. Mus. Nat. Hist. 20(2): 47-223.

HAAS, G. and Y. L. WERNER. 1969. Lizards and snakes from southwestern Asia, collected by Henry Field. Bull. Mus. Comp. Zool. 138(6):327-406.

HAIN, M. L. 1965. Ecology of the lizard *Uta mearnsi* in a desert canyon. Copeia 1965(1):78-81.

HALL, R. J. 1969. Ecological observations on Graham's watersnake (*Regina grahami* Baird and Girard). Amer. Midl. Nat. 81 (1):156-163.

HARDY, L. M. 1975. Revision of the colubrid snake genus *Gyalopion*. Jour. Herp. 9(1): 107-132.

HARLESS, M. 1978. Social behavior. Pp. 475-492 *in* Turtles, Perspectives and Research. Harless, M. and H. Morlock, ed. John Wiley and Sons, N.Y. 695 pp.

HARRIS, V. A. 1964. The life of the rainbow lizard. Hutchison Tropical Monographs. Hutchinson and Co. Ltd., London, 174 pp.

HATTORI, Z., T. INOUE and T. OKONOGI. 1974. In front of a pile of sea snake carcasses. The Snake 6:94-98.

HEBARD, W. B. 1936. Relationships and variation in the garter snakes, genus, Thamnophis of the Puget Sound region of Washington State. Herpetologica 6(4):97-101.

HENDERSON, R. W. and L. G. HOEVERS. 1979. Variation in the snake *Tretanorhinus nigroluteus lateralis* in Belize with notes on breeding tubercles. Herpetologica 35(3):245-248.

HERTZ, P. E. 1976. *Anolis alumina*, a new species of grass anole from the Barahona

peninsula of Hispaniola. Breviora 437, 19 pp.

Hidalgo, H. ms. Courtship and mating in *Rhinoclemys pulcherrima incisa* (Testudines: Emydidae: Batagurinae). Trans. Kansas Acad. Sci.

Hikida, T. 1980. Reproduction of the Japanese skink *(Eumeces latiscutatus)* in Kyoto. (unpublished ms.)

Hill, N. P. 1944. Sexual dimorphism in the Falconiformes. Auk 61:228-234.

Hoddenbach, G. A. and J. R. Lannom, Jr. 1967. Notes on the natural history of the Mexican gecko *Phyllodactylus tuberculosus*. Herpetologica 23(4):293-296.

Hoogmoed, M. S. 1973. Notes on the herpetofauna of Surinam. IV. The lizards and amphibians of Surinam. W. Junk, The Hague. 419 pp.

Huey, R. B. and E. R. Pianka. 1974. Ecological character displacement in a lizard. Amer. Zool. 14:1127-1136.

———. 1977. Patterns of niche overlap among broadly sympatric *versus* narrowly sympatric Kalahari lizards (Scincidae: *Mabuya*). Ecology 58(1):119-128.

Inger, R. F. and B. Greenberg. 1966. Annual reproductive patterns of lizards from a Bornean rain forest. Ecology 47(6):1007-1021.

Inger, R. F. and H. Marx. 1965. The systematics and evolution of the Oriental colubrid snakes of the genus *Calamaria*. Fieldiana: Zoology 49:1-304.

Iverson, J. B. 1977. Geographic variation in the musk turtle, *Sternotherus minor*. Copeia 1977(3):502-517.

———. 1979a. Reproduction and growth of the mud turtle, *Kinosternum subrubrum* (Reptilia, Testudines, Kinosternidae), in Arkansas. Jour. Herp. 13(1):105-111.

———. 1979b. Behavior and ecology of the rock iguana *Cyclura carinata*. Bull. Florida St. Mus. 24(3):175-358.

———. ms. Geographic variation in sexual dimorphism in the mud turtle, *Kinosternum hirtipes*.

Jackson, D. R. and R. Franz. ms. Aspects of the ecology of the eastern coral snake, *Micrurus fulvius fulvius*, in north-central Florida. submitted to Herpetologica.

Jenssen, T. A. 1973. Shift in the structural habitat of *Anolis opalinus* due to congeneric competition. Ecology 54(4):863-869.

Johnson, S. R. 1965. An ecological study of the chuckwalla *Sauromalus obesus* Baird, in the western Mojave Desert. Amer. Midl. Nat. 73(1):1-29.

Kassing, E. F. 1961. A life history study of the Great Plains ground snake, *Sonora episcopa* (Kennicott). Texas Jour. Sci., 13 (2):185-203.

Kennedy, J. P. 1965. Observations on the distribution and ecology of Barker's anole, *Anolis barkeri* Schmidt (Iguanidae). Zoologica 50:41-44.

King, W. 1969. The giant lizards of Komodo. Nature and Science 7(1):5-7.

Klauber, L. M. 1937. A statistical study of the rattlesnakes. IV. The growth of the rattlesnake. Occas. Papers San Diego Soc. Nat. Hist. no. 3:1-56.

———. 1940. The lyre snakes (genus *Trimorphodon*) of the United States. Trans. San Diego Soc. Nat. Hist. 9(19):163-194.

———. 1941. The long-nosed snakes of the genus *Rhinocheilus*. Trans. San Diego Soc. Nat. Hist. 9(29):289-332.

———. 1943. Tail-length difference in snakes with notes on sexual dimorphism and the coefficient of divergence. Bull. San Diego Soc. Nat. Hist., no. 18, 76 pp.

———. 1945. The geckos of the genus *Coleonyx* with descriptions of new subspecies. Trans. San Diego Soc. Nat. Hist. 10(11): 133-216.

———. 1946. The glossy snake, *Arizona*, with descriptions of new subspecies. Trans. San Diego Soc. Nat. Hist. 10(17):311-398.

Koba, K. 1938. Some notes on *Agkistrodon halys* (Pallas) from Syoryuzan Island, Kwangtung, South Manchuria (1). Zool. Mag. 50(5):245-264.

Koba, K. and D. Kikukawa. 1969. A taxonomic study of the Tokara-habu, *Trimeresurus tokarensis* from the Tokara Islands, Japan. Bull. Biogeogr. Soc. Japan, 25(1):1-8.

———. 1976. The morphology of *Trimeresurus elegans* (Serpentes: Viperidae). Bull. Ginkyo Coll. Med. Tech. no. 1:19-32.

Koba, K., D. Kikukawa, T. Fukada and K. Tanaka. 1977. A taxonomic study of *Calliophis japonicus* (Serpentes: Elapidae) of the Nansei Islands, Japan. Bull. Ginkyo Coll. Med. Tech. no. 2:7-30.

Kolata, G. B. 1977. Sexual dimorphism and mating systems: how did they evolve? Science 195:362-383.

Kopstein, F. 1941. Uber sexualdimorphismus bei Malaischen schlangen. Temminckia 6: 109-145.

Kroll, J. C. 1971. Combat behavior in male Great Plains ground snakes. Texas Jour. Sci. 33(2):306.

Kropach, C. 1975. The yellow-bellied sea snake *Pelamis* in the Eastern Pacific. Pp. 185-213. *In* The Biology of the Sea Snakes. Univ. Park Press, Baltimore.

Lanza, B. 1972. The natural history of the Cerbicale Islands (southeastern Corsica) with particular reference to their herpetofauna. Natura—Soc. Ital. Sci. Nat. Museo Civ. Stor. Nat. e Acquarino Civ., Milano 65(3-4):155-193.

Laurent, R. F. 1950. Revision du genre

Atractaspis A. Smith. Inst. Roy. des Sci. Nat. de Belgique 2nd ser. 38:49 pp.

———. 1956. Contribution à l'Herpétologie de la Région des Grands Lacs de l'Afrique centrale. Annales du Musée Royal du Congo Belge. Tervuren, Belgique 48, 390 pp.

———. 1964. Reptiles et amphibiens de l'Angola Museu do Dundo. Publicações Culturias No. 67:165 pp.

Laurent, R. F. and C. Gans. 1965. III. Lizards. Pp. 27-45 *in* Notes on a herpetological collection from the Somali Republic. Musée Royal de l'Afrique Centrale, Tervuren, Belgiques Annales. Sciences Zoologiques no. 134.

Lee, J. C. 1975. The autecology of *Xantusia henshawi henshawi* (Sauria: Xantusiidae). Trans. San Diego Soc. Nat. Hist. 17(19): 259-278.

Legler, J. M. 1954. Nesting habits of the western painted turtle, *Chrysemys picta bellii* (Gray). Herpetologica 10:137-144.

León, J. R. and L. J. Cova. 1973. Reproducción de *Cnemidophorus lemniscatus* (Sauria: Teiidae) en Cumaná, Venezuela. Carib. Jour. Sci. 13(1-2):63-73.

Leviton, A. E. 1959. Report on a collection of reptiles and amphibians from Afghanistan. Proc. California Acad. Sci. 4th ser. 29(12):445-463.

———. 1963. Contributions to a review of Philippine snakes, III. The genera *Maticora* and *Calliophis*. Philippine Jour. Sci. 92(4): 523-550.

———. 1964a. Contributions to a review of Philippine snakes, V. The snakes of the genus *Trimeresurus*. Philippine Jour. Sci. 93(2):251-276.

———. 1964b. Contributions to a review of Philippine snakes, VII. The snakes of the genera *Naja* and *Ophiophagus*. Philippine Jour. Sci. 93(4):531-550.

———. 1968. Contributions to a review of Philippine snakes, XI. The snakes of the genus *Boiga*. Philippine Jour. Sci. 97(3): 291-314.

———. 1970. Description of a new subspecies of *Rhabdophis auriculata* in the Philippines, with comments on the zoogeography of Mindanao Island. Proc. California Acad. Sci. 4th ser. 38(18):347-362.

Leviton, A. E. and S. C. Anderson. 1967. Survey of the reptiles of the sheikdom of Abu Dhabi, Arabian Peninsula. Part II. Systematic account of the collection of reptiles made in the sheikdom of Abu Dhabi by John Gasperetti. Proc. California Acad. Sci. 4th ser. 35(9):157-192.

———. 1970. Review of the snakes of the genus *Lytorhynchus* Proc. California Acad. Sci. 4th ser. 37(7):249-274.

Loveridge, A. 1948. New Guinean reptiles and amphibians in the Museum of Comparative Zoology and the United States National Museum. Bull. Mus. Comp. Zool. 101(2):305-430.

———. 1953. Zoological results of a fifth expedition to East Africa. III. Reptiles from Nyasaland and Tete. Bull. Mus. Comp. Zool. 110(3):143-322.

Loveridge, A. and E. E. Williams. 1957. Revision of the African tortoises and turtles of the suborder Cryptodira. Bull. Mus. Comp. Zool. 115(6):161-557.

Mahmoud, Y. 1967. Courtship behavior and sexual maturity in four species of kinosternid turtles. Copeia 1967(2):314-318.

Malnate, E. V. 1962. The relationships of five species of the Asiatic natricine snake genus *Amphiesma*. Proc. Acad. Nat. Sci. Philadelphia 114(3):251-299.

Malnate, E. V. and S. A. Minton. 1965. A redescription of the natricine snake *Xenochrophis cerasogaster* with comments on its taxonomic status. Proc. Acad. Nat. Sci. Philadelphia 117(2):19-43.

Marx, H. 1958. Egyptian snakes of the genus *Psammophis*. Fieldiana no. 18:191-200.

Maslin, T. P. 1950. Snakes of the Kiukiang-Lushan area, Kiangsi, China. Proc. California Acad. Sci. 4th ser. 26(12):419-466.

Maslin, T. P. and J. M. Walker. 1973. Variation, distribution and behavior of the lizard, *Cnemidophorus parvisocius* Zweifel (Lacertilia, Teiidae). Herpetologica 29(2):128-152.

Mayhew, W. W. 1965. Reproduction in the sand-dwelling lizard *Uma inornata*. Herpetologica 21(1):39-55.

———. 1966a. Reproduction in the psammophilous lizard *Uma scoparia*. Copeia 1966(1):114-122.

———. 1966b. Reproduction in the arenicolous lizard *Uma notata*. Ecology 47(1): 9-18.

———. 1971. Reproduction in the desert lizard, *Dipsosaurus dorsalis*. Herpetologica 27(1):57-77.

McCoy, C. J. 1970. II. The Bahamian subspecies. Pp. 118-151 *in* A systematic review of *Ameiva auberi* Cocteau (Reptilia, Teiidae) in Cuba and the Bahamas. Ann. Carnegie Mus. 41(4):45-168.

McDowell, S. R. 1979. A catalogue of the snakes of New Guinea and the Solomons, with special reference to those in the Bernice P. Bishop Museum. Part III. Boinae and Acrochordoidea (Reptilia, Serpentes). Jour. Herp. 13(1):1-92.

Medica, P. A. 1967. Food habits, habitat preference, reproduction, and diurnal activity in four sympatric species of whiptail lizard *(Cnemidophorus)* in south central New Mexico. Bull. S. California Acad. Sci. 66(4):251-276.

Mendelssohn, H. 1963. On the biology of

the venomous snakes of Israel. Pt. 1. Israel Jour. Zool. 12:143-170.

———. 1965. On the biology of the venomous snakes of Israel. Pt. 2. Israel Jour. Zool. 14:185-212.

Mertens, R. 1930. Die Amphibien und Reptilien der Inseln Bali, Lombok, Sumbawa, und Flores. Abhandl. Senckenberg. Naturforsch. Gesell. 42(3):115-344.

———. 1931. *Ablepharus boutoni* (Desjardin) und seine geographische Variation. Abdruck aus Zoologische Jahrbucher Abteilung für Systematik, Ökologie und Geographie der Tiere 61 1/2:63-210.

———. 1955a. Die Amphibien und Reptilien Südwestafrikas. Abhandlungen der Senckenbergischen Naturforschenden Gesellschaft. 490:1-172.

———. 1955b. Die Mauereidechsen der Liparischen Inseln, gesammelt von Dr. Antonino Trischitta. Senck. Biol. 36(1/2): 25-40.

———. 1955c. Die Mauereidechsen Kalabriens, Siziliens und einiger benachbarter Inseln. Senck. Biol. 36(3/4):219-234.

———. 1956. Zur Kenntnis der Iguaniden-Gattung *Tropidurus* in Peru. Senck. Biol. 37(1/2):101-136.

———. 1958. Bemerkungen über die Warane Australiens. Senck. Biol. 39(5/6):229-264.

———. 1959a. Studien *Lacerta trilineata* aus Rumänien mit Beschreibung einer neuen Unterart. Senck. Biol. 40(1/2):25-42.

———. 1959b. Amphibien und Reptilien von Karimundjawa, Bawean und den Kangean-Inseln. Treubia 25(1):1-15.

———. 1961. Die Rassen der Schmetterlingsagame, *Leiolepis belliana*. Senck. biol. 42 (5/6):507-510.

———. 1962. Die Arten und Unterarten der Geckonengattung *Phelsuma*, Senckenbergiana Biologica 43(2):81-127.

———. 1964a. Das Rätsel der Eidechsen von Santo Stefano. Zool. Jahrb. Syst. Biol. 92: 91-102.

———. 1964b. Funf neue Rassen der Geckonengattung *Phelsuma*. Studien über die Reptilien fauna Madagaskars V. Senck. biol. 45(2):99-112.

Mertens, R. and O. Schnurre. 1949. Eidoniische und okologische Studien am Smaragdeidechsen. Abh. der Senckenbergischen Naturforschenden Gesellschaften Deutschlands. 481:1-28.

Michael, E. D. 1972. Growth rates in *Anolis carolinensis*. Copeia 1972(3):575-577.

Milstead, W. W. 1961. Observations on the activities of small animals (Reptilia and Mammalia) on a quadrat in southwest Texas. Amer. Midl. Nat. 65(1):127-138.

Minakami, K. 1979. An estimation of age and life span of the genus *Trimeresurus* (Reptilia, Serpentes, Viperidae) on Amami Oshima Island, Japan. Jour. Herp. 13(2): 147-152.

Minnich, J. E. 1971. Seasonal variation in weight-length relationships and fat body size in the desert iguana, *Dipsosaurus dorsalis*. Copeia 1971(2):359-362.

Mitchell, F. J. 1973. Studies on the ecology of the agamid lizard *Amphibolurus maculosus* (Mitchell). Trans. Royal Soc. S. Australia 97(1):47-76.

Mittermeier, R. A. 1971. Notes on the behavior and ecology of *Rhinoclemys annulata* Gray. Herpetologica 27(4):485-488.

Moehn, L. D. 1967. A combat dance between two prairie kingsnakes. Copeia 1967(2): 480-481.

Moll, E. O. 1973. Latitudinal and intersubspecific variation in reproduction of the painted turtle, *Chrysemys picta*. Herpetologica 29(4):307-318.

Moll, E. O. and J. M. Legler. 1971. The life history of a neotropical slider turtle, *Pseudemys scripta* (Schoepf) in Panama. Bull. Los Angeles Co. Mus. Nat. Hist., Science no. 11, 102 pp.

Montanucci, R. R. 1973. Systematics and evolution of the Andean lizard genus *Pholidobolus* (Sauria: Teiidae). Univ. Kansas Misc. Publ. 59, 52 pp.

Mossimann, J. E. and J. R. Bider. 1960. Variation, sexual dimorphism, and maturity in a Quebec population of the common snapping turtle, *Chelydra serpentina*. Canadian Jour. Zool. 38:19-38.

Mount, R. H. 1965. Variation and systematics of the scincoid lizard, *Eumeces egregius* (Baird). Bull. Florida St. Mus., Biol. Sci. 9(5):183-213.

Myers, C. W. 1967. The pine woods snake, *Rhadinea flavilata* (Cope). Bull. Florida St. Mus., Biol. Sci. 11(2):48-97.

———. 1974. The systematics of *Rhadinea* (Colubridae), a genus of New World snakes. Bull. Amer. Mus. Nat. Hist. 153, art. 1, 262 pp.

Nevo, E., G. Gorman, M. Soulé, S. Yung Yang, R. Clover and V. Jovanovic. 1972. Competitive exclusion between insular *Lacerta* species (Sauria, Lacertidae). Notes on experimental introductions. Oecologia 10:183-190.

Nussbaum, R. A. and L. V. Diller. 1976. The life history of the side-blotched lizard, *Uta stansburiana* Baird and Girard, in north-central Oregon. Northwest Science 50(4): 243-260.

Nussbaum, R. A. and R. F. Hoyer. 1974. Geographic variation and the validity of subspecies in the rubber boa, *Charina bottae* (Blainville). Northwest Science 48(4):219-229.

Okada, Y. 1937. Studies on the lizards of

Japan. II. Agamidae. Zool. Inst. Tokyo Univ. 3:83-94.

Oliver, J. A. 1948. The anoline lizards of Bimini, Bahamas. Amer. Mus. Novit. 1383: 36 pp.

Parker, W. S. 1971. Ecological observations on the regal horned lizard *(Phrynosoma solare)* in Arizona. Herpetologica 27(3): 333-338.

———. 1972. Aspects of the ecology of a Sonoran Desert population of the western banded gecko, *Coleonyx variegatus* (Sauria, Eublepharinae). Amer. Midl. Nat. 88(1): 209-224.

Parker, W. S. and E. R. Pianka. 1975. Comparative ecology of populations of the lizard *Uta stansburiana.* Copeia 1975(4):615-632.

———. 1976. Ecological observations on the leopard lizard *(Crotaphytus wislizenii)* in different parts of its range. Herpetologica 32:93-114.

Peters, J. A. 1960. The snakes of the subfamily Dipsadinae. Misc. Publ. Mus. Zool. Univ. Michigan. no. 114, 224 pp.

Pianka, E. R. and W. S. Parker. 1972. Ecology of the iguanid lizard *Callisaurus draconoides.* Copeia 1972(3):493-508.

———. 1975. Ecology of horned lizards: a review with special reference to *Phrynosoma platyrhinos.* Copeia 1975(1):141-162.

Pianka, E. R. and H. D. Pianka. 1970. The ecology of *Moloch horridus* (Lacertilia: Agamidae) in western Australia. Copeia 1970:90-103.

Pienaar, U. de V. 1966. The reptile fauna of the Kruger National Park. Koedoe no. 1, 223 pp.

Pitman, C. R. S. 1974. A guide to the snakes of Uganda. Wheldon and Wesley Ltd., Glasgow. 290 pp.

Plummer, M. V. 1977. Activity, habitat and population structure in the turtle, *Trionyx muticus.* Copeia 1977(3):431-440.

Plummer, M. V. and D. B. Farrar. ms. Sexual dietary differences in a population of *Trionyx muticus* (Reptilia: Testudines). Submitted to Herpetologica.

Polozhinzki, V. F. and A. S. Khalansky. 1964. Biology of the viviparous lizard *(Lacerta vivipara)* in the central Urals. (Translation of selected abstracts from Voprosy Gerpetologii, edited by Paul V. Terentev, U. of Leningrad) 84 pp.

Pope, C. H. 1935. The reptiles of China, turtles, crocodilians, snakes, lizards. Natural history of Central Asia, vol. 10, xlii + 600 pp. Published by the American Museum of Natural History.

Prestt, I. 1971. An ecological study of the viper *Vipera berus* in southern Britain. Jour. Zool. (London) 164(3):373-418.

Quinn, H. R. 1979. Reproduction and growth of the Texas coral snake *(Micrurus fulvius tenere).* Copeia 1979(3):453-463.

Ralls, K. 1976. Mammals in which females are larger than males. Quart. Rev. Biol. 51:245-276.

Rand, A. S. 1967. Ecology and social organization in the iguanid lizard *Anolis lineatopus.* Proc. U.S. Nat. Mus. 122, 79 pp.

Renjifo, J. M. 1979. Systematics and distribution of crotalid snakes in Colombia. (M.A. Dissertation, University of Kansas.)

Reynolds, R. T. 1972. Sexual dimorphism in accipiter hawks: a new hypothesis. Condor 74:191-197.

Rica, J. and P. Martinez. 1971. Contribución al estudio de la Biología de los gecónidos ibéricos (Rept., Sauria). Publ. Centro Pirenaico Biol. Exper. V.S., 291 pp.

Rigley, L. 1971. "Combat dance" of the black rat snake *Elaphe o. obsoleta.* Jour. Herpetology 5:65-66.

Rodgers, T. L. and H. S. Fitch. 1947. Variation in the skinks (Reptilia: Lacertilia) of the Skiltonianus Group. Univ. California Publ. Zool. 48(4):169-220.

Roze, J. A. 1964. Pilgrim of the river. Nat. Hist. 73(7):34-41.

Ruibal, R. and E. E. Williams. 1961. The taxonomy of the *Anolis homolechis* complex of Cuba. Bull. Mus. Comp. Zool. 125(8): 211-246.

Saint Girons, H. 1973. Nouvelles donnes sur la vipere naine du haut Atlas, *Vipera latastei monticola.* Bull. Soc. Sci. Nat. et Physiques Maroc 53:111-118.

———. 1978. Morphologie extrene comparée et systématique des Vipères d'Europe (Reptilia, Viperidae). Revue Suisse Zool. 85(3): 565-595.

Savage, J. M. 1960. A revision of the Ecuadorian snakes of the colubrid genus *Atractus.* Misc. Publ. Mus. Zool. Univ. Michigan 112, 86 pp.

Savage, J. M. and J. L. Vial. 1974. The venomous coral snakes (genus *Micrurus*) of Costa Rica. Rev. Trop. Biol. 21(2): 295-349.

Schmidt, K. P. 1923. Contributions to the herpetology of the Belgian Congo based on the collection of the American Museum Congo Expedition, 1909-1915. Bull. Amer. Mus. Nat. Hist. 49(1):1-146.

Schoener, T. W. 1967. The ecological significance of sexual dimorphism in size in the lizard *Anolis conspersus.* Science 155: 474-477.

———. 1970. Size patterns in West Indian Anolis lizards. II. Correlations with the sizes of particular sympatric species displacement and convergence. American Naturalist 104:155-174.

Schoener, T. W. and A. Schoener. 1971a. Structural habitats of West Indian Anolis

lizards. I. Lowland Jamaica. Breviora 368, 53 pp.

———. 1971b. Structural habitats of West Indian Anolis lizards. II. Puerto Rican uplands. Breviora 375, 39 pp.

Schwaner, T. D. 1980. Reproductive biology of lizards on the American Samoan Islands. Occas. Paper Mus. Nat. Hist. Univ. Kansas, no. 86, 53 pp.

Schwartz, A. 1959. Variation in lizards of the *Leiocephalus cubensis* complex in Cuba and the Isla de Piños. Bull. Florida State Mus. Bio. Sci. 4(4):97-143.

———. 1960. Variation in the Cuban lizard *Leiocephalus raviceps* Cope. Proc. Biol. Soc. Washington 73:67-82.

———. 1965a. A review of the colubrid snake genus *Arrhyton* with a description of a new subspecies from southern Oriente Province, Cuba. Proc. Biol. Soc. Washington 78: 99-114.

———. 1965b. Two new subspecies of the anguid lizard *Wetmorena* from Hispaniola. Proc. Biol. Soc. Washington 78:39-48.

———. 1967. The *Leiocephalus* (Lacertilia Iguanidae) of Hispaniola. II. The *Leiocephalus personatus* complex. Tulane Studies in Zoology 14(1):53 pp.

———. 1968a. The Cuban lizards of the *Anolis homolechis* complex. Tulane Studies in Zoology 14(4):140-184.

———. 1968b. Geographic variation in the New World gekkonid lizard *Tarentola americana* Gray. Proc. Biol. Soc. Washington 81:123-142.

———. 1970. I. The Cuban subspecies. Pp. 45-117 *in* A systematic review of *Ameiva auberi* Cocteau (Reptilia, Teiidae) in Cuba and the Bahamas. Ann. Carnegie Mus. 41(4):45-168.

———. 1974a. A new species of primitive *Anolis* (Sauria Iguanidae) from the Sierra de Baoruco, Hispaniola. Breviora. 423:19 pp.

———. 1974b. An analysis of variation in the Hispaniolan giant anole, *Anolis ricordi* Duméril and Bibron. Bull. Mus. Comp. Zool. 146(2):89-146.

———. 1975a. A new subspecies of *Sphaerodactylus copei* Steindachner (Sauria, Gekkonidae) from Hispaniola. Herpetologica 31(1):1-18.

———. 1975b. Variation in the Cuban boid snake *Tropidophis haetianus*. Jour. Herp. 9(3):303-311.

———. 1978. The Hispaniolan *Anolis* (Reptilia, Lacertilia, Iguanidae) of the *hendersoni* complex. Jour. Herp. 12(3):355-370.

Schwartz, A. and R. I. Crombie. 1975. A new species of the genus *Aristelliger* (Sauria: Gekkonidae) from the Caicos Islands. Proc. Biol. Soc. Washington 88(27): 305-314.

Schwartz, A. and O. H. Garrido. 1975. A reconsideration of some Cuban *Tropidophis* (Serpentes, Boidae). Proc. Biol. Soc. Washington 88(9):77-90.

Seigel, R. A. 1979. Preliminary observations on the population dynamics of the diamondback terrapin, *Malaclemys terrapin tequesta*, Merritt Island National Wildlife Refuge, Brevard Co., Florida. Abstracts of papers 1979 ASIH 59th Annual meeting.

Shealy, R. M. 1976. The natural history of the Alabama map turtle, *Graptemys pulchra* Baur, in Alabama. Bull. Florida St. Mus., Biol. Sci. 21(2):47-111.

Sheplan, R. R. and A. Schwartz. 1974. Hispaniolan boas of the genus *Epicrates* (Serpentes, Boidae) and their Antillean relationships. Ann. Carnegie Mus. 45(5): 57-143.

Sherbrooke, W. C. 1975. Reproductive cycle of a tropical lizard *Neusticurus ecpleopus* Cope, in Peru. Biotropica 7(3):194-207.

Shine, R. 1977. Reproduction in Australian elapid snakes. Australian Jour. Zool. 25: 647-653 and 655-666.

———. 1978a. Growth rates and maturation in six species of Australian elapid snakes. Herpetologica 34(1):73-78.

———. 1978b. Sexual size dimorphism and male combat in snakes. Oecologia 33: 269-277.

———. 1979. Sexual selection and sexual dimorphism in the Amphibia. Copeia 1979 (2):297-306.

———. 1980a. Reproduction, feeding and growth in the Australian burrowing snake *Vermicella annulata*. Jour. Herpetology 14 (1):71-77.

———. 1980b. Comparative ecology of three Australian snake species of the genus *Cacophis* (Serpentes: Elapidae). Copeia 1980: 831-838.

———. 1980c. Ecology of the Australian death adder, *Acanthophis antarcticus* (Serpentes, Elapidae). Herpetologica 34(1): 73-78.

Smith, A. G. 1949. The subspecies of the Plains garter snake, *Thamnophis radix*. Bull. Chicago Acad. Sci. 8(14):285-300.

Smith, H. M. 1963. The taxonomic status of the Black Hills population of smooth green snakes. Herpetologica 19(4):256-261.

———. 1965. Two new colubrid snakes from the United States and Mexico. Jour. Ohio Herp. Soc. 5(1):1-4.

Smith, H. M. and E. Laufe. 1946. A summary of the Mexican lizards of the genus *Ameiva*. Univ. Kansas Sci. Bull. 31(1):7-73.

Smith, H. M., C. W. Nixon and P. W. Smith. 1950. Mexican and Central American garter snakes *(Thamnophis)* in the British Museum (Natural History). Jour. Linn. Soc. 41(17):571-584.

SMITH, H. M., R. B. SMITH and H. L. SAWIN. 1977. A summary of snake classification (Reptilia, Serpentes). Jour. Herpetology 11(2):115-121.

SMITH, M. A. 1935. The fauna of British India, including Ceylon and Burma. Reptilia and Amphibia. II. Sauria. Taylor and Francis, London. xiii + 440 pp.

———. 1943. The fauna of British India, including Ceylon and Burma. Reptilia and Amphibia. III. Serpentes. Taylor and Francis, London. xii + 583 pp.

———. 1951. The British amphibians and reptiles. Collins, London. xiv + 318 pp.

SPELLERBERG, I. F. and T. E. PHELPS. 1977. Biology, general ecology, and behavior of the snake *Coronella austriaca* Laurenti. Biol. Jour. Linn. Soc. London 9:133-164.

STATON, M. A. and J. R. DIXON. 1977. Breeding biology of the spectacled caiman, *Caiman crocodilus crocodilus,* in the Venezuelan llanos. U.S. Dept. Int. Fish & Wildlife Rept. 5, 21 pp.

STICKEL, L. F., W. H. STICKEL and F. C. SCHMID. 1980. Ecology of a Maryland population of black rat snakes *(Elaphe o. obsoleta).* Amer. Midl. Nat. 103(1):1-14.

TANNER, W. W. 1944. A taxonomic study of the genus *Hypsiglena.* Great Basin Nat. 5(3 and 4):25-92.

———. 1957. A taxonomic and ecological study of the western skink *(Eumeces skiltonianus).* Great Basin Nat. 17(3-4):59-94.

TANNER, W. W. and B. H. BANTA. 1966. A systematic review of the Great Basin reptiles in the collection of the Brigham Young University and the University of Utah. Great Basin Nat. 26(3-4):87-135.

TAYLOR, E. H. 1956. A review of the lizards of Costa Rica. Univ. Kansas Sci. Bull. 38 Pt. 1(1):322 pp.

———. 1965. The serpents of Thailand and adjacent waters. Univ. Kansas Sci. Bull. 45(9):609-1006.

THOMAS, R. 1975. The *Argus* group of West Indian *Sphaerodactylus* (Sauria: Gekkonidae). Herpetologica 31:177-195.

THORNHILL, R. 1980. Rape in *Panorpa* scorpionflies and a general rape hypothesis. An. Behav. 28:52-59.

TRAPIDO, H. 1944. The snakes of the genus *Storeria.* Amer. Midl. Nat. 31(1):1-84.

TRAVASSOS, H. 1946. Estudo de variaçao de *Mabuya punctata* (Gray, 1839). Boletino Mus. Nac. Nov. Ser. Zool. 60:56 pp.

TRIVERS, R. L. 1972. Parental investment and sexual selection. *In* Sexual selection and the descent of man. (B. J. Campbell, ed.) Pp. 136-177.

UZZELL, T. M., JR. 1966. Teiid lizards of the genus *Neusticurus* (Reptilia, Sauria). Bull. Amer. Mus. Nat. Hist. 132(5):279-327.

———. 1969. A new genus and species of teiid lizard from Bolivia. Postilla, Peabody Mus. Yale Univ. no. 129, 15 pp.

VAN DENBURGH, J. 1914. The gigantic land tortoises of the Galapagos Archipelago. Expedition of the California Academy of Sciences to the Galapagos, 1905-1906. Proc. California Acad. Sci., 4th ser. 2:203-374.

VAN DEVENDER, R. W. 1978. Growth ecology of a tropical lizard, *Basiliscus basiliscus.* Ecology 59(5):1031-1038.

VANZOLINI, P. E. 1955. Contribuições ao conhecimento dos lagartos brasileiros da família Amphisbaenidae Gray, 1825. V. Distribuição geográfica e biometria de *Amphisbaena alba* L. Arquivos do Museu Nacional, Rio de Janeiro, D.F., 42:683-706.

VANZOLINI, P. E. and R. REBOUÇAS-SPIEKER. 1969. On a large and surprising sample of *Calliscincopus agilis* from Brasil, with the invalidation of the genus (Sauria, Teiidae). Papéis Avulsos Zool. 22(13):123-144, Sec. Agr., São Paulo.

VAZ-FERREIRA, R. and B. S. DE SORIANO. 1960. Notas sobre reptiles de Uruguay. Univ. Uruguay, Rev. Fac. Human Cienc. no. 18: 133-206.

VITT, L. J. and R. D. OHMART. 1977a. Ecology and reproduction of lower Colorado River lizards: I. *Callisaurus draconoides* (Iguanidae). Herpetologica 33(2):214-222.

———. 1977b. Ecology and reproduction of lower Colorado River lizards: II. *Cnemidophorus tigris* (Teiidae) with comparisons. Herpetologica 33(2):223-234.

VOGT, R. C. 1980. Natural history of the map turtles, *Graptemys pseudogeographica* and *G. ouachitensis* in Wisconsin. Tulane Studies in Zool. and Bot. 22(1):17-48.

VORIS, H. K. and B. C. JAYNE. 1979. Growth, reproduction and population structure of a marine snake, *Enhydrina schistosa* (Hydrophiidae). Copeia 1979(2):307-318.

WALKER, J. M. 1970. Morphological variation and clutch size in a population of *Cnemidophorus lineatissimus* Cope in Michoacan, Mexico. Herpetologica 26(3):359-365.

WALKER, J. M. and T. P. MASLIN. 1969a. A review of the San Pedro Nolasco whiptail lizard (*Cnemidophorus bacatus* Van Denburgh and Slevin). Amer. Midl. Nat. 82 (1):127-139.

WALKER, W. F., JR. 1945. A study of the snake, *Tachymenis peruviana* Wiegmann and its allies. Bull. Mus. Comp. Zool. 96 (1):1-55.

WALL, F. 1911. *Tropidonotus stolatus in* A popular treatise on the common Indian snakes. Jour. Bombay Nat. Hist. Soc. Part 14, 20:603-632.

———. 1912. *Helicops schistosus in* A popular treatise on the common Indian snakes. Jour. Bombay Nat. Hist. Soc. Part 18, 21: 1009-1021.

———. 1921. Ophidia Taprobanica or the snakes of Ceylon. H. R. Cottle, Govt. Printer, Ceylon. 581 pp.

Waltner, R. C. 1978. Comparative ecology of *Agama tuberculata* Gray at different altitudes in the western Himalayas. (Ph.D. Dissertation, University of Kansas.)

Webb, R. G. 1958. The status of the Mexican lizards of the genus *Mabuya*. Univ. Kansas Sci. Bull. 38, pt. 2, no. 17:1303-1313.

———. 1970. Another new night lizard (Xantusia) from Durango, Mexico. Los Angeles County Mus. Contrib. Sci. no. 194, 10 pp.

Webb, R. G., J. K. Jones and G. W. Byers. 1962. Some reptiles and amphibians from Korea. Univ. Kansas Mus. Nat. Hist. 15(2): 149-173.

Wellman, J. 1963. A revision of snakes of the genus *Conophis* (Family Colubridae, from Middle America). Univ. Kansas Publ. Mus. Nat. Hist. 15(6):251-295.

Werner, Y. L. 1971. Lizards and snakes from Transjordan recently acquired by the British Museum (Natural History). Bull. Brit. Mus. Nat. Hist. 21(6):215-256.

White, J. B. and G. W. Murphy. 1973. The reproductive cycle and sexual dimorphism of the common snapping turtle, *Chelydra serpentina serpentina*. Herpetologica 29(3): 240-246.

Whitford, W. B. and W. G. Whitford. 1973. Combat in the horned lizard, *Phrynosoma cornutum*. Herpetologica 29:191.

Wilbur, H. M. 1975. The evolutionary and mathematical demography of the turtle *Chrysemys picta*. Ecology 56:64-77.

Williams, E. E. 1972. The origin of faunas. Evolution of lizard congeners in a complex island fauna: a trial analysis. Evol. Biol. 6:47-90.

———. 1974. The second Anolis newsletter. (Mimeographed leaflet, Mus. Comp. Zool., Harvard Univ.)

Williams, E. E. and T. P. Webster. 1974. *Anolis rupinae* a new species, a syntopic sibling of *A. monticola* Shreve. Breviora 429:22 pp.

Wilson, L. D. and D. E. Hahn. 1973. The herpetofauna of the Islas de Bahia, Honduras. Bull. Florida St. Mus. 17(2):93-148.

Wilthof, D. C. 1963. Reproduction in the tropical Australian skink, *Leiolopisma rhomboidalis*. Amer. Midl. Nat. 70(2):442-461.

Witte, G. F. de. 1941. Exploration du Parc National Albert. Batracians et Reptiles. Inst. des Parcs Nationaux du Congo Belge 33:1-261.

———. 1953. Exploration du Parc National de l'Upemba. Reptiles. Inst. des Parcs Nationaux du Congo Belge 6:1-322.

———. 1965. Les caméléons de l'Afrique Centrale (République démocratique du Congo, République Rwanda et Royaume de Burundi). Mus. Roy. Afrique Centr., Tervaren, Belgique Annales, Ser. In., 8°, Sci. Zool. 142, 215 pp.

Witte, G. F. de and R. Laurent. 1947. Revision d'un groupe de Colubridae Africains Genres *Calamelaps, Miodon, Aparallactus*, et formes affines. Mem. de Musee Royal d'Histoire Naturelle de Belgique. Ser. 2, fasc. 29, 134 pp.

Wood, J. F. and W. D. Duellman. 1950. Size and scutellation in *Natrix septemvittata* (Say). American Midl. Nat. 43(1):173-178.

Woodbury, A. M. and R. Hardy. 1948. Studies of the desert tortoise, *Gopherus agassizii*. Ecol. Monogr. 18:145-200.

Worrell, E. 1964. Reptiles of Australia. Angus and Robertson, xv + 207 pp.

Wright, A. H. and A. A. Wright. 1957. Handbook of snakes of the United States and Canada. Comstock Publ. Associates, Cornell Univ. Press, vol. 1, xviii + 564 pp., vol. 2, ix + 565-1105 pp.

Zug, G. R., S. B. Hedges and S. Sunkel. 1979. Variation in reproductive parameters of three neotropical snakes, *Coniophanes fissidens, Dipsas catesbyi*, and *Imantodes cenchoa*. Smithsonian Contrib. Zool. 300: 20 pp.

Zweifel, R. G. 1959. Variation and distribution of lizards of western Mexico related to *Cnemidophorus sacki*. Bull. Amer. Mus. Nat. Hist. 117(2):63-116.

## APPENDIX I

### Alphabetical list of reptiles, with female-to-male percentages, snout-vent lengths

Following each FMR figure, where available, are the male average and (in parentheses) the range and the number in the sample series; the same figures for females follow, and finally the source, abbreviated to the initials of the author(s) with the year of publication. These sources correspond with the publications listed in the Literature Cited in most instances. However, the abbreviation HSF* indicates figures from my own unpublished field data or museum specimens examined. The abbreviation *var* for "various sources" is used in instances where data are based on two or more publications.

*Ablepharus kitaibelii* 115 39.7(33-47) 45.7(35-51) IEF & SV 61.

*Ablepharus wahlbergii* 110.6 42.0(38-46 in 4) 46.5(44-52 in 4) *var.*

**Acanthodactylus cantoris 87** 54(39-85 in 17) 47(36-58 in 14) SCA 63.

**Acanthophis antarcticus 131** 440(320-670 in 73) 578(375-825 in 50) RS 80C.

*Achalinus spinalis* 125.4 265.6(217-340 in 5) 332.4(320-368 in 5) *var.*

*Agama agama* 86.4 (99-123 in 7) (80-112 in 7) *var.*

**Agama agilis 87.4** 87.3(79-94 in 26) 76.2(64-89 in 20) SCA 63.

*Agama atricollis* 89.3 153.2(134-171 in 5) 137.7(118-153 in 4) *var.*

*Agama hispida* 95.2 103.3(82-134 in 10) 98.5 (82-118 in 8) *var.*

**Agama pallida 109.3** 61.2(55-67 in 20) 67.0 (59-81 in 20) YLW 71.

**Agama tuberculata 93** 121(100-140 in 96) 113 (96-138 in 149) RCW 78.

**Agkistrodon contortrix 93.5** 627.9(501-890 in 116) 586.9(500-678 in 98) HSF*.

*Agkistrodon halys* 112 664.2(480-784 in 9) 743 (697-840 in 4) KK 38.

**Agkistrodon piscivorus 96** 565(450-900 in 96) 493(450-800 in 90) RDB 66.

*Ahaetulla prasina* 121.5 792(710-874 in 5) 962 (773-1075 in 12) FK 41.

**Alligator mississippiensis 73** 3500 2550 (total lengths) RHC & TJ 79.

*Alopoglossus atriventris* 105.9 41-46 43-49 JRD & PS 75.

*Alopoglossus copi* 111.1 51.2(44-51 in 5) 57.0 (48-62 in 7) WED ms.

*Amblyodipsas unicolor* 149.5 431(366-495 in 4) 702(410-705 in 4) *var.*

**Amblyrhynchus cristatus 85** 341 290 JBI 79.

**Ameiva ameiva 95** 114(90-142 in 110) 105 (90-125 in 78) WED ms.

**Ameiva auberi 82.6** 93(78-136 in 23) 77(60-115 in 23) AS 70.

**Ameiva festiva 86.1** 104.1(94-115 in 16) 89.6 (78-104 in 27) HSF*.

*Ameiva quadrilineata* 96.6 72.5(66-79) 70.0 (62-78) HFH 63.

**Ameiva undulata 83.8** 103.6(93-115 in 43) 86.9(78-106 in 74) HSF*.

**Amphibolurus maculosus 91** 67 61 FJM 73.

*Amphiesma sauteri* 115.5 260(237-282 in 8) 300.5(261-333 in 10) EVM 62.

**Amphiesma stolata 133** 411(400-429 in 11) 587.4(478-654 in 10) FW 11.

**Amphisbaena alba 103.1** 433(305-537 in 34) 447(353-655 in 43) PEV 55.

*Amphisbaena fuliginosa* 97 (251-397) (224-402) in 17 JRD & PS 75.

**Anniella geronimensis 94** 120.2(111-134 in 20) 113.0(111-129 in 18) HSF*.

*Anniella pulchra* 102 129.2(119-142 in 13) 123.0(110-132 in 9) HSF*.

**Anolis aeneus 71** 69.2(67-72 in 10) 49.3(48-52 in 10) TS & AS 71A.

**Anolis allisoni 74** 82.6 in 70 61.0 in 43 TWS 70.

**Anolis allogus 75.4** 56.7 in 202 42.7 in 97 TWS 70.

**Anolis alutaceus 92.0** 35.8 in 55 32.8 in 70 TWS 70.

**Anolis angusticeps 88** 42.0 in 26 37.0 in 37 TWS 70.

*Anolis aquaticus* 88.7 65.9(57-71 in 10) 58.6 (59-62 in 9) HSF 76.

**Anolis argillaceus 81** 44.3 35.8 TWS 70.

**Anolis attenuatus 95** 84.5(78-95 in 24) 80.6 (74-90 in 18) HSF 76.

*Anolis auratus* 104.4 44.6(40-49 in 31) 46.6 (43-49 in 8) HSF 76.

**Anolis auratus sipaliwinensis 104** 43.9(39-48 in 14) 45.9(42-50 in 11) MSH 73.

**Anolis bimaculatus 71** 85.5 60.5 EEW 74.

**Anolis biporcatus 102** 87.0(73-98 in 24) 88.7 (77-97 in 19) HSF 76.

**Anolis biscutiger 106** 37.3(33-43 in 42) 39.4 (36-44 in 33) HSF 76.

*Anolis bombiceps* 110 55-71 65-74 JRD & PS 75.

**Anolis bourgaei 103.1** 54.6(47-61 in 24) 56.3 (46-65 in 13) HSF 76.

*Anolis bremeri* 70 65.3(58-72 in 9) 45.6(39-52 in 9) OHG 72.

**Anolis brevirostris 89** 47.0 in 79 42.0 in 28 TWS 70.

**Anolis capito 106.4** 84.2(78-90 in 13) 89.6 (83-96 in 13) HSF 76.

**Anolis carolinensis 79** 59.9(54-66 in 14) 47.3 (41-53 in 12) HSF 76.

*Anolis carpenteri* 105 38.5(35-41 in 6) 40.4 (35-41 in 14) HSF 76.

**Anolis chlorocyaneus 76** 71.4 in 184 54.0 in 90 TWS 70.

**Anolis christophei 92** 47.6 43.7 TS 70.

**Anolis chrysolepis 105** 71.5(66-79 in 29) 74.4 (67-80 in 32) HSF 76.

**Anolis coelestinus 78.3** 68.6 in 414 53.6 in 174 TWS 70.

**Anolis concolor 74** 68.3(60-80 in 70) 50.5(45-60 in 44) MJC & PLD 73.

**Anolis cooki 70** 59.5 41.6 TWS & AS 71B.

*Anolis crassulus* 88 48.3(39-53 in 8) 42.7(35-56 in 7) HSF 76.

**Anolis cristatellus 79** 63.6 in 327 44.6 in 204 TWS 70.

**Anolis cupreus 88** 47.4(41-53 in 233) 41.7(37-48 in 239) HSF 76.

**Anolis cupreus hoffmanni 97** 44.1(38-52 in 314) 42.6(38-51 in 166) HSF 76.

**Anolis cupreus macrophallus 82** 49.6(43-54 in 53) 40.8(34-46 in 33) HSF 76.

**Anolis cupreus spilomelas 84** 49.6(41-55 in 57) 41.7(36-49 in 23) HSF 76.

**Anolis cuprinus 73** 63.3(58-69 in 22) 46.5(42-53 in 15) HSF 76.

**Anolis cuvieri 92** 41.7 in 22 38.4 in 13 TWS 70.

**Anolis cybotes 77** 65.3 in 230 50.2 in 133 TWS 70.

*Anolis damulus* 110 43.1(37-48 in 9) 47.5(41-52 in 12) HSF 76.

**Anolis distichus 87** 50.2 in 450 43.2 in 262 WED & AS 58.

*Anolis distichus biminiensis* 90 46.7(38.3-49.8 in 10) 41.8(36.3-44.2 in 4) JAO 48.

**Anolis dollfusianus 94** 39.0(35-43 in 54) 36.7 (32-40 in 42) HSF 76.

**Anolis equestris 93** 170.9 in 95 158.4 in 66 TWS 70.

**Anolis evermanni 74** 70.7 52.4 TWS & AS 71B.

**Anolis frenatus 82** 132.4(121-143 in 15) 108.9 (100-118 in 20) HSF 76.

**Anolis fuscoauratus 108** 42.0(39-43 in 12) 45.3 (40-50 in 12) HSF 76.

*Anolis fuscoauratus kugleri* 102 44.5(40-49 in 9) 45.3(41-48 in 10) MSH 73.

**Anolis gadovii 89** 70.6(62-76 in 10) 62.6(56-69 in 12) HSF 76.

**Anolis garmani 75** 110 82.5 TWS 70.

**Anolis gemmosus 94** 62.5(58-66 in 38) 58.5 (56-63 in 28) HSF 76.

**Anolis grahami 68** 65.5 44.0 TWS & AS 71A.

**Anolis grahami aquarum 73** 61.8 45.1 TWS & AS 71A.

**Anolis gundlachi 69** 64.8 45.2 TWS & AS 71B.

**Anolis hendersoni 84** 47.9 in 165 40.2 in 86 TWS 70.

*Anolis heteropholidotus* 109 48.6(45-51 in 10) 53.1(49-58 in 7) HSF 76.

**Anolis homolechis 78** 52.3 in 355 40.7 in 107 TWS 70.

**Anolis humilis 105** 36.7(32-43 in 155) 38.5 (34-43 in 106) HSF 76.

**Anolis intermedius 99** 46.0(39-54 in 241) 45.5 (39-53 in 98) HSF 76.

*Anolis isthmicus* 89 54.4(50-63 in 25) 48.4 (44-58 in 9) HSF*.

**Anolis kemptoni 104** 48.0(45-53 in 13) 50.1 (46-54 in 21) HSF 76.

**Anolis krugi 79.4** 49.7 39.3 TWS & AS 71B.

**Anolis lemurinus 104** 67.0(59-79 in 13) 69.6 (59-78 in 16) HSF 76.

**Anolis limifrons** (Costa Rica) **103** 37.5(33-43 in 392) 38.6(34-45 in 276) HSF 76.

**Anolis limifrons** (Panama) **99** 43.9(38-48 in 8) 43.25(41-46 in 8) HSF 76.

**Anolis lineatopus 69** 60(50-70) 42(37-47) TAJ 73.

**Anolis lionotus 84.8** 71.5(65-78 in 19) 60.6 (56-68 in 24) HSF 76.

*Anolis loysiana* 89 40.4 in 18 36.0 in 7 TWS 70.

**Anolis lucius 84** 63.3 in 156 53.2 in 108 TWS 70.

**Anolis megapholidotus 98** 45.6(41-53 in 28) 44.6(41-49 in 14) HSF 76.

**Anolis nebulosus 100** 42.0(35-49 in 58) 42.0 (35-49 in 44) HSF 76.

**Anolis nigrolineatus 94** 50.9(47-55 in 14) 48.0 (45-51 in 15) HSF 76.

**Anolis occultus 100** 39.0 39.2 TWS & AS 71B.

**Anolis olssoni 91** 44.8 in 91 40.6 in 84 TWS 70.

**Anolis opalinus 82** 49.5 40.5 TWS & AS 71A.

*Anolis ortoni* 96 46.8(43-54 in 9) 44.8(42-48 in 8) HSF 76.

**Anolis pachypus 101** 45.5(40-50 in 32) 46.0 (41-50 in 24) HSF 76.

*Anolis pentaprion* 81 74.2(70-79 in 5) 60.0 (57-63 in 5) HSF 76.

*Anolis peraccae* 93 49.9(46-52 in 21) 46.3(44-48 in 9) HSF 76.

**Anolis pinchoti 90** 46.2(40-52 in 95) 41.5(38-46 in 59) MJC & PLD 73.

*Anolis poecilopus* 96 63.5(56-72 in 8) 61.0 (56-68 in 9) HSF 76.

**Anolis polylepis 93** 50.9(45-57 in 40) 47.3(41-53 in 48) HSF 76.

**Anolis poncensis 87** 45.6 39.6 TWS & AS 71B.

**Anolis porcatus 72** 71.2 in 114 51.5 in 62 TWS 70.

**Anolis pulchellus 80** 46.1 in 108 37.0 in 24 TWS 70.

*Anolis punctatus* 88 80.5(79-83 in 4) 71.5(64-77 in 12) HSF 76.

*Anolis punctatus boulengeri* 103 65-80 66-75 JRD & PS 75.

**Anolis quercorum 89** 40.1(37-46 in 26) 35.8 (32-41 in 16) HSF*.
**Anolis richardi 81** 68.3(65-74 in 10) 66.6(65-69.8 in 10) TS 70.
**Anolis rodriguezi 101** 43.3(40-46 in 15) 43.7 (40-49 in 23) HSF 76.
**Anolis roquet 77** 74(72-76 in 10) 56.9(53-62 in 10) TS 70.
**Anolis sagrei 73** 54.5 in 192 39.7 in 62 HSF 76.
**Anolis sagrei stejnegeri 79** 53.9(49-60 in 20) 42.4(40-44 in 20) WED & AS 58.
**Anolis semilineatus 86** 40.7 in 57 35.2 in 34 TWS 70.
**Anolis sericeus 90** 45.4(40-52 in 47) 41.0(36-47 in 34) HSF 76.
**Anolis subocularis 76** 51.0(44-63 in 49) 38.8 (33-48 in 19) HSF 76.
*Anolis stratulus* 86 46.7 in 63 39.9 in 7 TWS & AS 71B.
**Anolis taylori 79** 71.8(64-78 in 45) 57.0(53-64 in 21) HSF 76.
**Anolis trachyderma 115** 44.4(38-52 in 129) 51.2(46-57 in 101) HSF 76.
**Anolis tropidogaster 96** 50.0(43-55 in 24) 48.0 (43-54 in 15) HSF 76.
**Anolis tropidolepis 99** 50.6(43-59 in 298) 50.1 (43-58 in 175) HSF 76.
**Anolis tropidonotus 81** 52.3(46-55 in 16) 42.4 (36-53 in 34) HSF 76.
**Anolis uniformis 98.1** 37.4(35-40 in 29) 36.7 (34-38 in 13) HSF 76.
**Anolis valencienni 86.3** 79.4 68.5 TWS & AS 71.
**Anolis villai 89** 51.5(43-60 in 64) 46.0(37-53 in 28) HSF & RWH 76.
*Anolis vittigerus* 125.4 52.3(45-57 in 7) 65.6 (60-70 in 7) HSF 76.
**Anolis wattsi 87** 47.5 41.2 EEW 74.
*Anolis woodi* 86.6 80.8(78-87 in 4) 69.9(61-77 in 10) HSF 76.
*Aparallactus lunulatus* 131 284(261-315 in 4) 373(310-410 in 4) *var.*
*Aparallactus modestus* 120 386(377-402 in 4) 465(435-483 in 4) *var.*
*Aplopeltura boa* 102.5 499(413-546 in 6) 511 (455-582 in 11) FK 41.
*Aporosaura anchietae* 89.8 49 44 SRG & MDB 79.
**Arthrosaura kockii 107** 46.4(40-54 in 13) 49.5 (45-53 in 13) MSH 73.
*Arthrosaura reticulata* 86 57-66 45-61 JRD & PS 75.
*Atheris squamiger* 112.8 479(369-559 in 4) 540(416-598 in 5) *var.*
*Atractaspis bibroni* 110.8 512(370-575 in 6) 566.5(470-611 in 4) *var.*
*Atractaspis irregularis* 110 494(466-541 in 5) 543(510-621 in 5) *var.*
*Atractus carrioni* 142 216(135-280 in 5) 307 (260-350 in 5) JMS 60 (incl. juv.).
**Atractus elaps 111** 344.5(152-560 in 34) 382 (134-631 in 23) JMS 60 (incl. juv.).
**Atractus major 111** 326(120-852 in 32) 364 (140-852 in 24) JMS 60 (incl. juv.).
*Atractus multicinctus* 110 284(262-300) 314 (286-354) JMS 60 (incl. juv.).
*Atractus occipitoalbus* 126 189(93-269 in 7) 231(135-298 in 14) JMS 60 (incl. juv.).
*Atretium schistosum* 120 431 in 7 518 in 7 FW 12.
**Austrelaps superbus 92.1** 766 in 10 706 in 27 RS 77.

*Bachia flavescens (cophias)* 108 64.8(60-73 in 9) 70(58-80 in 15) MSH 73.
*Bachia flavescens (vermiforme)* 99 57-64 55-65 JRD & PS 75.
*Bachia trinasale* 104 65.5(56-72 in 11) 68.1(59-79 in 9) WED ms.
**Basiliscus basiliscus 78** 218 170 RWV 78.
**Basiliscus vittatus 85.5** 140.9(121-167 in 29) 120.5(110-131 in 17) HSF*.
**Bitis arietans 93.1** 865.6(762-1030 in 21) 806.6 (710-965 in 12) VFMF 30.
**Blanus cinereus 100** 210(197-254 in 12) 210 (194-235 in 18) JB & HStG 63.
*Boaedon lineatus* 140 629(443-801 in 4) 879 (618-1047 in 8) *var.*
*Boiga dendrophila* 96 1392(993-1607 in 4) 1332(1275-1395 in 6) FK 41.
*Boiga pulverulenta* 106 825(764-884 in 4) 874 (840-944 in 4) *var.*
**Bothrops atrox 115.4** 872.7(701-1200 in 59) 1007.4(706-1390 in 53) HSF*.
**Bothrops lansbergi 101** 357(255-476 in 33) 361(250-500 in 52) JR 79.
**Bothrops nasutus 96.4** 354.7(273-450 in 23) 337.1(270-450 in 17) JR 79.
*Bothrops pulcher* 153 353.6(333-374 in 4) 540.5(435-634 in 8) JR 79.
*Bothrops punctatus* 144 580(517-678 in 8) 833.7(550-1065 in 8) JR 79.
**Bothrops schlegelii 111** 420.8(304-557 in 11) 466.3(302-704 in 14) JR 79.
*Brachymeles gracilis* 93 (59.4-86) (57.2-78) WCB & DSR 67.

**Cacophis krefftii 112.2** 235 264 RS 80B.
**Cacophis harriettae 124.6** 286 357.6 RS 80B.
**Cacophis squamulosus 129** 390 in 48 502 in 61 RS 80B.
**Calamaria agamensis 117.7** 237(200-268 in 28) 279(245-326 in 27) FK 41.
*Calamaria gervaisi* 126 191(170-210 in 8) 254 (190-321 in 9) RFI & HM 65.
**Calamaria lumbricoidea 115** 413(384-485 in 26) 477(337-555 in 36) CPJH 41.
**Calamaria multiplicata 126** 218.1(183-260 in 159) 275.5(225-358 in 155) CPJH 41.
*Calamaria pavimentata* 116 238.2(193-286 in 5) 266.2(219-336 in 9) RFI & HM 65.
**Calamaria virgulata 116.1** 296(211-330 in 16) 343.7(275-390 in 10) FK 41.
**Callisaurus draconoides 89** 78.9(70-88 in 43) 70.2(63-80 in 46) ERP & WSP 72.

**Callisaurus draconoides rhodostictus 89.7** 68.8 (31-89 in 13) 61.6(33-80 in 24) HSF*.
**Candoia carinata 137** 568.9(487-640 in 10) 780(544-1089 in 23) SBM 79.
**Carphophis vermis 116.7** 244.1(216-288 in 90) 285(208-325 in 73) HSF*.
*Causus lichtensteini* 115.2 464(376-574 in 4) 537(442-660 in 4) *var.*
*Causus rhombeatus* 95 664.2(503-830 in 5) 632(540-740 in 7) *var.*
*Cemophora coccinea* 79 832 650 AHW & AAW 57.
*Cerastes cerastes* 120 514.4(415-640 in 7) 617.25(567-760 in 4) AEL & SCA 67.
*Cerberus rhynchops* 118 480.2(420-556 in 6) 566.5(482-618 in 4) FK 41.
*Cercosaura ocellata* 103 50-65 54-63 in 52 JRD & PS 75.
*Chamaeleo bitaeniatus* 101 116(74-108 in 4) 117.3(79-97 in 4) *var.*
*Chamaeleo dilepis* 107 131.3(71-172 in 10) 140(97-164 in 9) *var.*
*Chamaeleo etiennei* 109 79.3(68-97 in 8) 86.4 (65-115 in 15) *var.*
**Chamaeleo namaquensis 106** 112.6(75-158 in 30) 119.6(88-140 in 50) BRB 73.
**Chamaeleo pumilis 107.1** 73.5(53-93 in 65) 78.8(51-102 in 86) BRB 73.
**Chamaeleo quilensis 120** 94(86-111 in 19) 112.5(89-127 in 11) RFL 64.
**Chamaeleolis chamaeleonides 99** 161.7 in 12 160.5 in 33 TS 70.
*Charina bottae* 112.2 499 561 RAN & RFH 74.
*Charina bottae utahensis* 122.2 444 543 RAN & RFH 74.
*Chelonia mydas* 106.2 904(710-1040) 960(787-1143) CHE & PWB 72.
*Chelydra serpentina* 100 254(191-355 in 18) 255(211-259 in 9) JLC & RRB 79.
**Chrysemys picta 139** 114(116-220 in 15) 158.1 (130-155 in 30) JWG 67.
*Chrysopelia paradisi* 124 573(470-700 in 8) 770(480-910 in 5) RM 68.
*Clelia rustica* 96.7 706(520-950 in 7) 681(450-875 in 9) FA 73.
**Clemmys guttata 100** 80 in 10 80 in 10 RBB 79.
*Clemmys marmorata* 100 100-120 100-120 RBB 79.
**Clemmys muhlenbergii 107** 67.0(61.8-89.7 in 76) 71.7(67.9-86.9 in 74) CE 77.
*Clonophis kirtlandi* 110 525-675 550-775 AHW & AAW 57.
*Cnemidophorus bacatus* 91.6 78.3 in 6 71.7 in 6 JMW & TPM 69.
*Cnemidophorus calidipes* 91.4 73.8(70-79 in 25) 67.2(66-68 in 6) WED 60.
**Cnemidophorus deppei 92.8** 73.2(60-92 in 182) 67.9(60-81 in 260) HSF*.
*Cnemidophorus guttatus* 93 106(89-128 in 12) 98(83-112 in 8) HSF*.
**Cnemidophorus hyperythrus 97.4** 61.4(55-72 in 97) 59.7(53-70 in 116) DLB 66.
**Cnemidophorus inornatus 103.5** 56.0(50.5-65) 58(47-66) PAM 67.
**Cnemidophorus lemniscatus 79.4** 76.7(60-97 in 201) 60.9(50-78 in 194) JRL & LJC 73.
**Cnemidophorus lineatissimus 89.4** 91.5(78-105 in 28) 81.7(75-90 in 14) JMW 70.
**Cnemidophorus parvisocius 91.1** 64.8(52-79 in 274) 59.0(50-69 in 172) TPM & JMW 73.
*Cnemidophorus sacki* 93.3 70.7(55-58) 66(45-95) WWM 61.
**Cnemidophorus sexlineatus 100.8** 72.7(65-81 in 88) 73.3(65-83 in 96) HSF*.
**Cnemidophorus tigris 93.7** 83.5(70-95 in 44) 78.1(70-87 in 75) HSF*.
**Coleodactylus amazonicus 105** 21.2(20-23 in 18) 22.3(18-24 in 17) MSH 73.
**Coleonyx variegatus 106.8** 58.4(53-65 in 55) 62.3(56-70 in 23) WSP 72.
**Coleonyx variegatus utahensis 113.9** 54.1(37-66 in 16) 61.6(44-70 in 12) WWT & BHB 66.
**Coluber constrictor 110** 721(513-1110 in 181) 795(538-1210 in 177) HSF*.
*Coluber jugularis* 71.1 1496.6(1160-1840) 1065.8(500-1272) IEF & SV 61.
*Coluber spinalis* 126 501(375-572 in 9) 631.2 (483-755 in 7) CHP 35.
*Coluber viridiflavus* 86.3 800.1(685-873 in 7) 690.1(633-790 in 6) SB 68.
**Coluber viridiflavus xanthurus 77** 1208.5(740-1365 in 10) 930.4(865-1085 in 10) SB 70.
**Coniophanes fissidens 113.6** 263(225-335 in 15) 298.8(230-425 in 27) GRZ, SBH & SS 79.
*Conolophus subcristatus* 91.1 383(350-417 in 8) 349(313-383 in 8) CCC 69.
**Coronella austriaca 102** 515(440-600 in 31) 526 (440-600 in 27) IFS & TEP 77.
*Corythophanes cristatus* 109 98.6(79-117 in 5) 107.2(80-120 in 9) HSF*.
**Cosymbotus platurus 98.5** 55.0(53.7-56.3 in 122) 54.1(52.9-56.8 in 173) GC 62.
**Crocodylus niloticus 85.2** 3416(3073-3743 in 14) 2911(2600-3192 in 50) (total length) HBC 61.
**Crotalus atrox 90.6** 963 in 87 873 in 56 LMK 37.
**Crotalus cerastes 103.3** 537 in 53 555 in 42 LMK 37.
**Crotalus durissus 88** 1512 in 10 1334 in 10 LMK 37.
**Crotalus durissus terrificus 97** 754(450-965 in 12) 731(405-1140 in 18) JR 79.
**Crotalus enyo 92** 796 in 10 736 in 10 LMK 37.
**Crotalus horridus 94** 1073 in 10 1010 in 10 LMK 37.
*Crotalus lepidus* 82.4 596(545-648 in 4) 492 (445-540 in 4) AHW & AAW 57.
**Crotalus lepidus klauberi 84.6** 528 in 37 447 in 32 LMK 37.
**Crotalus lucasensis 87.1** 1055 in 162 919 in 110 LMK 37.
**Crotalus mitchelli 93.6** 842 in 49 788 in 27 LMK 37.

**Crotalus mitchelli pyrrhus 78** 1092 in 10 847 in 10 LMK 37.
**Crotalus mitchelli stephensi 88** 840 in 10 740 in 10 LMK 37.
**Crotalus molossus 90.5** 967 in 37 875 in 23 LMK 37.
**Crotalus molossus nigrescens 84** 1156 in 10 969 in 19 LMK 37.
*Crotalus pricei* 82 562 in 10 460 in 10 LMK 37.
**Crotalus ruber 84** 1285 in 10 1075 in 10 LMK 37.
**Crotalus scutulatus 87.9** 858 in 121 754 in 48 LMK 37.
**Crotalus tigris 82** 767 in 10 632 in 10 LMK 37.
**Crotalus triseriatus 90** 555 in 10 499 in 10 LMK 37.
**Crotalus viridis 91.5** 753 in 274 682 in 222 MK 37.
**Crotalus viridis concolor 88** 601 in 10 526 in 10 LMK 37.
**Crotalus viridis helleri 79.5** 1102-1300 in 10 860-1052 in 10 AHW & AAW 57.
**Crotalus viridis lutosus 89.7** 875 in 96 784 in 48 LMK 37.
**Crotalus viridis nuntius 78** 688 in 10 537 in 10 LMK 37.
**Crotalus viridis oreganus 86.7** 691 in 127 599 in 83 LMK 37.
**Crotaphopeltis hotamboeia 105** 527(370-636 in 14) 563.6(435-710 in 11) *var.*
**Crotaphytus collaris 92.7** 100.9(95-109 in 24) 93.6(78-112 in 56) HSF*.
**Cryptoblepharus boutoni 102** 44(41.5-46.5 in 30) 45(39.5-49.5 in 28) RM 31.
**Ctenosaura similis 80** 345(200-489 in 610) 276 (200-347 in 283) HSF & RWH 78.
**Cyclura carinata 81.6** 276.3(191-360 in 47) 225.4(190-292 in 45) JBI 79B.
**Cyclura cornuta 92** 534.5±3.88 468.0±10.87 JBI 79B.
**Cyclura cychlura 93.4** 303 283 JBI 79B.
**Cyclura pinguis 86** 534.5 468.0 WMC 75.
**Cyrtodactylus malayanus 109** 98.9(82-107 in 119) 107.7(97-117 in 36) RFI & BG 66.
**Cyrtodactylus pubisculus 110.2** 66.4(57-72 in 54) 73.3(69-78 in 15) RFI & BG 66.

*Dasypeltis scabra* 117.1 564(425-710 in 8) 661 (505-848 in 14) *var.*
*Deirochelys reticularia* 194 75-85 150-160 RBB 70.
*Dendrelaphis picta* 114.3 500.3(445-594 in 8) 572(435-646 in 24) FK 41.
**Diadophis punctatus 111** 249(215-312 in 227) 279(221-368 in 408) HSF*.
*Dinodon flavozonatum* 82.6 883(790-1170 in 5) 729.7(590-990 in 4) CHP 35; MAS 43.
*Dinodon orientale* 100 40-80 40-80 HF 65.
*Dinodon rufozonatum* 96.1 816.4(708-910 in 5) 785.1(540-990 in 7) CHP 35; TPM 50.
*Dipsadoboa unicolor* 83.7 812.1(653-1093 in 5) 680(635-725 in 4) *var.*
**Dipsas catesbyi 96.3** 395.9(260-520 in 99) 381.2(270-580 in 105) HSF*.
**Dipsosaurus dorsalis 95** 127(115-145 in 377) 120(110-142 in 200) JEM 71.
*Dispholidus typus* 102 1021.1(740-1290 in 8) 1047(805-1293 in 9) *var.*
**Draco melanopogon 105.6** 79.5(67-87 in 343) 84.0(77-90 in 83) RFI & BG 66.
**Draco quinquefasciatus 101.5** 96(87-107 in 248) 97.4(86-107 in 62) RFI & BG 66.
**Drymoluber dichrous 73.5** 1041(802-1140 in 11) 695.3(610-785 in 13) HSF*.
*Duberria lutrix* 118.2 263.7(164-355 in 8) 312.9 (161-384 in 10) *var.*

*Echis carinata* 129 471-531 587-717 CRSP 74.
*Echis colorata* 97.7 642(551.5-728 in 20) 627 (553-732.5 in 21) HM 65.
**Elaphe climacophora 102** 1325(1188-1720 in 39) 1344(1210-1530 in 22) HF 78.
*Elaphe conspicillata* 100 900-1200 900-1200 HF 65.
*Elaphe dione* 103 773.2(650-843 in 4) 794.3 (720-885 in 4) CHP 35.
*Elaphe flavolineata* 103.7 1045(885-1178 in 5) 1084(960-1198 in 8) FK 41.
*Elaphe longissima* 85.6 1126.6(835-1347) 963.7 (665-1120) IEF & SV 61.
**Elaphe obsoleta 96.0** 1058(801-1530 in 256) 1016(800-1372 in 168) HSF*.
*Elaphe porphyriaca* 100 701.2(678-733 in 6) 700(651-742 in 5) CHP 35.
**Elaphe quadrivirgata 92** 900-1300 700-1200 HF 65.
*Elaphe radiata* 107.9 1065(819-1267 in 13) 1149(1018-1218 in 7) FK 41.
**Elapoides fuscus 110** 337(267-399 in 153) 371 (308-434 in 155) FK 41.
**Emoia adspersa 101.1** 74.0(72-84 in 111) 74.9 (70-81 in 21) TDS 79.
**Emoia atrocostata 96.5** 92.7(88-100 in 20) 89.6(85-95 in 15) ACA & WCB 67.
**Emoia cyanura 99.0** 48.3(42-58 in 195) 47.7 (41-56 in 82) TDS 80.
**Emoia lawesii 101.7** 98(90-106 in 16) 99.7 (94-104 in 20) TDS 80.
**Emoia nigra 94** 108(93-120 in 107) 101.7(88-113 in 70) TDS 80.
**Emoia samoensis 93.5** 107(90-115 in 47) 100 (89-113 in 37) TDS 80.
**Emydoidea blandingii 95.1** 215.5(182-234 in 41) 204.2(179-218 in 33) TEG & TSD 79.
*Emys orbicularis* 106 149.6(142-163) 158.5 (146-171) IEF & SV 61.
*Enhydrina schistosa* 111 782(800-858 in 4) 847(890-950 in 4) HKV & BCJ 79.
**Enhydris enhydris 109.3** 397(333-446 in 16) 434(378-513 in 18) FK 41.
**Enyaliosaurus clarki 92.9** 153 142 WED & ASD 59.
*Enyalioides laticeps* 100 115(100-128 in 14) 114.5(102-125 in 17) WED ms.
*Epicrates cenchria* 114 955(790-1257 in 13)

1089(975-1330 in 6) JWA, ECB & RD 65.
*Eremias arguta* 93.4 59.7 55.8 IEF & SV 61.
*Eremias guttulata* 99 48.0(39-53 in 7) 47.5 (38-57 in 6) SCA 63.
*Eremias lugubris* 96 172(168-178 in 4) 165 (159-171 in 4) (total lengths) VFMF 30.
*Eremias namaquensis* 90 160.8(145-184 in 14) 144.8(130-157 in 8) (total lengths) VFMF 30.
**Eremias savagei 97.7** 41.9(33-48 in 29) 40.9 (35-50 in 27) RFL & CG 65.
*Eretmochelys imbricata* 103.7 315.6(312-320) 327(255-360) RHM 65.
*Eublepharis angramainyu* 88.8 142-154 in 8 126-137 in 5 SCA & AEL 66B.
*Eumeces brevirostris* 103.6 62.2(60-69 in 4) 64.5(60-71 in 4) JRD 69.
**Eumeces egregius 106** 42.5(34-48 in 33) 45.1 (37-54 in 37) RHM 65.
**Eumeces fasciatus 98.8** 72.7(66-82 in 120) 71.9(66-79 in 180) HSF°.
**Eumeces gilberti 90** 91.3±1.4 in 59 82.4±1.1 in 31 TLR & HSF 47.
**Eumeces gilberti cancellosus 97** 86.9±1.6 in 31 84.3±.92 in 35 TLR & HSF 47.
**Eumeces gilberti placerensis 95** 89.6±.22 in 23 85.5±2.4 in 21 TLR & HSF 47.
**Eumeces gilberti rubricaudatus 102** 86.5±1.17 in 40 88.1±1.35 in 18 TLR & HSF 47.
**Eumeces inexpectatus 97.9** 66.8(55-77 in 11) 65.4(49-78 in 18) WED & AS 58.
**Eumeces latiscutatus 98.0** 71.5(63.3-87.7 in 10) 70.0(58.8-81.3 in 11) TH 78.
**Eumeces obsoletus 101.8** 111.9(100-128 in 146) 113.9(100-136 in 128) HSF°.
*Eumeces ochoterenae* 102 48.3 49.4 JRD 69.
*Eumeces septentrionalis* 101.1 78.6(71-85 in 5) 79.5(71-85 in 6) HSF°.
**Eumeces skiltonianus 101** 62.7±.42 in 166 63.2±.48 in 134 TLR & HSF 47.
**Eumeces skiltonianus utahensis 103.6** 63.7(60.1-68.1 in 14) 66(62.0-70.5 in 19) WWT 57.

*Farancia abacura* 165 600-1090 920-1875 AHW & AAW 57.
*Farancia abacura reinwardti* 159 725-982 852-1790 AHW & AAW 57.
**Farancia erytrogramma 148.5** 622(270-870 in 17) 923(370-1340 in 27) JWG & JWC 77.
*Ficimia olivacea* 95 367(251-483) 350(250-450) LMH 75.
**Ficimia quadrangularis 95** 212.1(87-304 in 74) 201.7(127-280 in 25) LMH 75.
*Fordonia leucobalia* 119.2 383(337-511 in 6) 456.7(366-556 in 6) FK 41.

**Gambelia wislizenii 115.2** 102(88-110 in 36) 117.5(112-132 in 25) WSP & ERP 76.
*Gehyra australis* 103.8 63.4(59-68 in 5) 65.8 (63-70 in 5) RHB 64.
**Gehyra oceanica 97.0** 79.4(74-90 in 14) 77.0 (74-86 in 18) TDS 80.
*Gehyra variegata* 98.6 51.8(50-54 in 5) 51.0 (48-56 in 5) RHB 64.
*Geochelone elephantopus ephippium* 82.1 2580 (2325-2950 in 25) 2120(1840-2700 in 61) JVD 14.
*Geochelone elephantopus vicina* 98.6 2690 (2400-3320 in 10) 2650(2125-3120 in 35) JVD 14.
*Geochelone radiata* 93.0 360 in 11 334 in 15 WA 78.
*Geodipsas depressiceps* 116.1 296(230-360 in 4) 343.5(244-390 in 4) *var.*
*Geophis brachycephalus* 116.9 339 394 FLD 67.
*Geophis hoffmanni* 132 197 260 FLD 67.
*Geophis nasalis* 104.5 285 298 FLD 67.
*Geophis rhodogaster* 124 253 314 FLD 67.
*Geophis semidoliatus* 128.9 290 374 FLD 67.
**Gerrhonotus monticolus 93.6** 77.3(63-87 in 25) 72.4(63-85 in 24) HSF°.
*Gerrhonotus moreleti* 92.5 88.6(81-94 in 6) 82.0(77-88 in 13) HSF°.
**Gerrhonotus multicarinatus 97.5** 132.7(120-149 in 22) 129.4(120-142 in 20) HSF°.
**Gerrhonotus multicarinatus webbii 98.2** 132.8 (120-170 in 25) 130.5(120-152 in 22) HSF°.
**Gonatodes albogularis 100** 40.1(36-45 in 23) 40.1(36-42 in 18) HSF°.
*Gonatodes annularis* 101 47(40-50 in 6) 47.4 (39-55 in 7) MSH 73.
*Gonatodes concinnatus* 99 42.4(32-52 in 8) 42.0(35-49 in 12) WED ms.
*Gonatodes humeralis* 106 31-41 33-39 JRD & PS 75.
**Gongylosoma baliodeira 108** 258.8(217-305 in 35) 278.5(245-314 in 36) CPJH 41.
**Gopherus agassizii 92.2** 272(256-316 in 59) 251(231-301 in 32) AMW & RH 48.
*Gopherus polyphemus* 106 230-341 238-368 RBB 79.
*Graptemys barbouri* 195 (90-130) (150-230) RBB 79.
**Graptemys geographica 196** 115(93-136 in 45) 226(201-258 in 15) RCV 80.
*Graptemys kohni* 181.9 (90-130) (150-250) RBB 79.
*Graptemys nigrinoda* 142.9 (75-100) (100-150) RBB 79.
**Graptemys ouachitensis 167** 123(109-137 in 68) 205(163-242 in 265) RCV 80.
*Graptemys oculifera* 183.8 (75-110) (100-150) RBB 79.
**Graptemys pseudogeographica 169** 133(111-151 in 68) 225(193-274 in 109) RCV 80.
*Graptemys pulchra* 248 100(80-120) 248.5(212-285) RMS 76.
**Gyalopion canum 106** 211.9(116-292 in 39) 224.8(151-315 in 15) LMH 75.

**Hemiaspis signata 98.6** 43.1 in 53 43.3 in 15 RS 77.
**Hemidactylus frenatus 96** 53.5(52-54 in 179) 51.4(50-52 in 251) GC 62.
*Hemidactylus mabouia* 105.6 59-67 in 6 61-72 in 4 GFW 53.

**Hemidactylus turcicus 106.2** 40.4±1.3 in 70 43.0±1.5 in 51 JR & MP 71.

*Hemirhagerrhis nototaenia* 105.4 247.4(208-270 in 5) 261(197-315 in 6) *var.*

*Heterodon nasicus* 116 385-550 430-660 DRP 69.

*Heterodon platyrhinos* 107 400-1050 450-1200 DRP 69.

**Heteronotia binoei 107.8** 41.7(34-49 in 91) 45.0(39-49 in 27) RHB 68.

*Holarchus violaceus* 87.4 457.5(436-472 in 4) 400(381-429 in 4) *var.*

**Holbrookia maculata 107.6** 48.9(43-60 in 31) 52.6(42-63 in 70) HSF*.

*Holbrookia maculata approximans* 92.6 56.8 (54-61 in 7) 52.0(50-55 in 9) WWM 61.

**Homalopsis buccata 109** 625(510-800 in 26) 681(540-870 in 30) KG 70.

*Hydrophis torquatus* 97 813.6(705-918 in 4) 786.4(732-940 in 4) EHT 65.

**Ichnotropis capensis 95** 55.0(38.3-66.7 in 56) 52.3(40.6-61.7 in 52) RFL 64.

*Ichnotropis squamulosa* 94.9 220(208-235 in 8) 208.3(190-223 in 11) (total lengths) VFMF 30.

**Iguana iguana 91** 361(250-550 in 174) 327 (236-411 in 169) HSF & RWH 77.

*Imantodes cenchoa* 109 699.8(616-754 in 8) 762.9(690-831 in 10) HSF*.

*Imantodes lentiferus* 105 616(471-682 in 11) 645(534-710 in 4) WED ms.

*Iphisa elegans* 100 52.0(41-62) 52.2(46-60) JRD 64.

**Japalura swinhonis 94.9** 62.8(51-81 in 45) 60.3 (50-74 in 34) YO 37.

**Kentropyx calcaratus 97** 105(92-115 in 28) 102(94-116 in 24) WED ms.

*Kentropyx pelviceps* 96 75-115 in 29 80-111 in 23 JRD & PS 75.

**Kentropyx striatus 89** 88.5(72-124 in 12) 79 (72-94 in 17) MSH 73.

*Kerilia jerdoni* 103 512.6(362-854 in 7) 525.6 (351-900 in 7) EHT 65.

*Kinosternum bauri* 101 89.1(78.3-103.9 in 6) 89.8(74.1-110.7 in 15) WED & AS 58.

*Kinosternum bauri palmarum* 122 87.6(80.8-98.1) 107.6(101.6-119.0) WED & AS 58.

**Kinosternum flavescens 97.5** 103(80-115 in 23) 100.5(73-117 in 21) YM 67.

*Kinosternum subrubrum* 118 78.3(71.1-88.7) 92.5(75.5-106.9) JBI 79.

**Kinosternum subrubrum hippocrepis 100** 89.3 (65-108 in 21) 89.6(67-111 in 20) YM 67.

*Lacerta agilis* 108 71.8(60-75) 77.6(60-82) IEF & SV 61.

*Lacerta agilis chersonensis* 99.5 70.4(60-82) 70.1(61-84) IEF & SV 61.

**Lacerta melisellensis 88** (63.4 in 16) (55.7 in 40) EN, GG, MS, SYY, RC & VJ 72.

*Lacerta muralis* 101.8 58.7(51-63) 59.7(53-66) IEF & SV 61.

*Lacerta muralis maculiventris* 99 59.3(57-62) 58.8(57-61) IEF & SV 61.

*Lacerta pratincola* 116 47.1(41-51) 54.6(50.5-57) IEF & SV 61.

**Lacerta sicula 90.0** 62.6 in 31 56.0 in 42 RM 64.

*Lacerta sicula alveaoi* 92 (68-70) (57-70) SB 70.

*Lacerta sicula ciclopica* 94 (70-75 in 10) (65-71 in 7) RM 55.

*Lacerta sicula medemi* 88.3 (70-75) (60-68) in 21 RM 55.

*Lacerta taurica* 82 55.5 45.5 IEF & SV 61.

*Lacerta tiliquerta eiselti* 91 57.4(53-60 in 6) 52(49-55 in 4) BL 72.

*Lacerta tiliquerta maresi* 90 66.7(60-71 in 7) 60.8(54-64 in 4) BL 72.

**Lacerta trilineata media 103** 110.7(101-131 in 10) 113.6(100-137 in 10) JEF & RM 59.

**Lacerta trilineata trilineata 105.4** 107.7(104-131 in 10) 113.6(100-137 in 10) RM 59.

*Lacerta vauerselli* 102 52.4(46-60 in 21) 53.4 (46-59 in 7) GFW 41.

**Lacerta viridis 92.8** 112.8(92-123 in 26) 104.4 (93-119 in 24) RM & OS 49.

*Lacerta viridis chlornota* 91.9 115(100-127 in 9) 105.3(98-116 in 6) SB 70.

*Lacerta vivipara* 116 45(42-48) 52(49-55) VFP & ASK 64.

*Lacerta wagleriana* 92.3 (52-76 in 40) (49-60 in 68) SB 70.

*Lacerta wagleriana antoninoi* 87 (61-70 in 12) (52-60 in 13) SB 70.

*Lacerta wagleriana maritlinensis* 87.8 (53-70 in 23) (49-59 in 10) SB 70.

**Lampropeltis calligaster 90.9** 850.7(681-1185 in 78) 773.2(568-1070 in 75) HSF*.

**Lampropeltis getulus 87.1** 1299.8(865-1607 in 24) 1019(877-1485 in 9) FNB 21.

**Lampropeltis getulus boylii 94.7** 1077.3(919-1180 in 10) 1020.3(920-1220 in 12) FNB 21.

**Lampropeltis getulus holbrooki 87.5** 1067.2 (790-1634 in 18) 933.6(765-1145 in 21) FNB 21.

*Lampropeltis multicincta* 112 507-850 547-973 AHW & AAW 57.

*Lampropeltis pyromelana* 91 424-1067 519-840 AHW & AAW 57.

*Lampropeltis triangulum* 87.8 821.5(710-1115 in 17) 721.3(601-900 in 7) FNB 21.

*Lampropeltis triangulum elapsoides* 88.0 468.9 (400-599 in 9) 412.5(355-482 in 13) FNB 21.

**Lampropeltis triangulum syspila 96.6** 578.3 (420-797 in 47) 558.9(457-675 in 35) HSF*.

**Lapemis curtus 100** 828 827 ZH, TI & TO 74.

**Leimadophis reginae 111.9** 400.6(313-490 in 32) 448.3(350-580 in 45) HSF*.

*Leimadophis taeniurus* 105.4 391.7(302-440 in 7) 413.2(370-481 in 18) HSF*.

**Leiocephalus astictus 85** 69.2(58-79 in 15) 58.7 (55-62 in 10) AS 59.

**Leiocephalus cubensis 77** 88.4(64-110 in 37) 68.0(56-81 in 28) AS 59.

**Leiocephalus exotheotus 84** 59.8(46-70 in 19) 49.9(43-57 in 16) AS 59.

**Leiocephalus gigas 72** 100.7(80-121 in 23) 72.1 (61-83 in 30) AS 59.

*Leiocephalus macropus felinoi* 70 73-87 in 8 54-59 in 8 AS 59.

*Leiocephalus pambasileus* 78 83.4(66-95 in 11) 65.4(64-67 in 7) AS 59.

*Leiocephalus paraphrus* 76 83.9(55-98 in 9) 63.7(56-69 in 17) AS 59.

*Leiocephalus raviceps klinkowskii* 89 58.5(53-69 in 4) 51.9(46-59 in 8) AS 60.

**Leiocephalus raviceps uzzelli 82** 66.5(61-71 in 23) 54.5(52-57 in 11) AS 60.

**Leiocephalus sierrae 66** 73.2(60-81 in 33) 62.8 (57-67 in 30) AS 59.

**Leiocephalus stictigaster 83** 66.1(57-79 in 26) 54.9(48-72 in 27) AS 59.

**Leiolopisma rhomboidalis 100** 50.5(46-55 in 42) 50.5(48-56 in 33) DCW 63.

*Lepidodactylus lugubris* 102.1 36.9(35-39 in 6) 37.4(31-40 in 14) AHW 70.

*Leposoma guianensis* 103 35.6(30-37 in 8) 36.6 (30-39 in 14) MSH 73.

*Leposoma parietale* 105 33.0(29-38 in 53) 34.7 (31-39 in 24) WED ms.

**Leptodeira annulata 107.5** 509.5(442-580 in 52) 547.9(480-635 in 51) HSF°.

**Leptophis ahaetulla 90.6** 1021(848-1145 in 11) 928(815-1000 in 12) HSF°.

*Liolaemus anomalus* 91 (55-80 in 9) (54-72 in 7) JMC 79.

**Liolaemus archeforus 90.5** 74.4(69-87 in 10) 82.1(76-92 in 10) JMC 75.

*Liolaemus archeforus sarmentiori* 93.8 (80-85) (75-80) JMC 75.

**Liolaemus kingii 91.6** 77-100 in 14 72-90 in 14 JMC 75.

**Liophis miliaris 123.8** 539(382-738 in 123) 667(480-993 in 244) CG 64.

**Lipinia noctua 101** 43.7(37-49 in 22) 44.3 (41-49 in 22) TDS 80.

*Lycophidion capense* 133 343.2(310-391 in 6) 454.8(302-533 in 6) *var.*

*Mabuya bayoni* 105 68.8-72.6 in 8 70-80 in 15 RFL 64.

*Mabuya brachypoda* 100.6 72.5(64-84 in 8) 73.0(64-88 in 6) EHT 56.

*Mabuya buettneri* 120 71 85 RB 74.

**Mabuya mabouya 112.1** 71.6(66-91 in 21) 80.3 (72-91 in 18) HSF°.

*Mabuya mabouya alliacea* 105.8 70.8(66-76 in 10) 74.8(71-88 in 5) EHT 56.

**Mabuya maculilabris 98** 71.2(52-84 in 16) 69.9 (55-77 in 17) RFL 64.

*Mabuya multifasciata* 94 101.5(90-113) 95(87-103) RM 30.

*Mabuya occidentalis* 108 72 78 RBH & ERP 77.

**Mabuya punctata 88** 83.2(66-92 in 48) 72.1 (62-92 in 52) HT 46.

*Mabuya quinquetaeniata margaritifer* 88.1 262 (253-273 in 5) 230.9(220.5-241 in 6) VFMF 30 (total lengths).

**Mabuya sparsa 86.5** 73.5(61-85 in 13) 63.5 (66-85 in 21) CKB 69.

**Mabuya spilogaster 104.4** 67.0±.75 in 88 70.0±.62 in 131 RBH & ERP 77.

**Mabuya striata 101.1** 77.7(68.5-91 in 47) 78.6 (67.5-92 in 42) VFMF 30.

*Mabuya varia* 105.5 57.9(55-60 in 4) 61.0(53-70 in 5) *var.*

*Mabuya variegata* 111 35 39 RBH & ERP 77.

**Macrochelys lacertina 86.4** 460(370-570 in 25) 397(33-50 in 33) JLD 71.

*Macropisthodon rudis* 139 558.0(543-590) 783.3(770-805) CHP 35.

*Malaclemys terrapin* 158 100-140 150-230 CHE & RWB 72.

*Malaclemys terrapin centrata* 143.5 115(100-123 in 13) 165(155-176 in 9) RS 80.

**Malaclemys terrapin tequesta 140.5** 123(109-144 in 26) 173(142-205 in 181) RS 80.

**Masticophis lateralis 106** 593 627 AHW & AAW 57.

*Masticophis taeniatus* 95.4 600-1050 575-1000 AHW & AAW 57.

*Masticophis taeniatus ruthveni* 95.6 1031 981 AHW & AAW 57.

*Maticora intestinalis* 98.6 487.4(426-560 in 5) 480.5(455-528 in 5) FK 41.

*Meroles cuneirostris* 90.6 54 49 SRG & MDR 79.

**Micrurus fulvius 133.5** 555(450-710 in 61) 740 (570-990 in 39) DRJ & RF 80.

**Micrurus fulvius tenere 118.9** 466(388-601 in 46) 554.2(355-950 in 92) HBQ 79.

**Moloch horridus 113.2** 84.6(79-96 in 31) 96.0 (82-110 in 33) ERP & HDP 70.

*Naja melanoleuca* 85 2040(1660-2692 in 4) 1732(1353-2591 in 4) *var.*

**Naja naja 98.9** 1048(928-1240 in 16) 1033 (943-1168 in 14) FK 41.

*Naja nigricollis* 102 1211(905-1555 in 9) 1148 (713-1470 in 7) *var.*

*Natriciteres olivacea* 125.4 328(287-382 in 5) 412(338-460 in 5) *var.*

**Natrix annularis 137.5** 411(340-500 in 49) 565 (475-695 in 27) TPM 50.

*Natrix natrix* 114 557.7(430-660) 634.4(420-830) IEF & SV 61.

**Natrix natrix sicula 114.5** 610(510-755 in 14) 699(525-1000 in 28) SB 70.

*Natrix percarinata* 136 564(530-638 in 6) 766 (620-1047 in 6) *var.*

*Natrix tessellata* 102.5 549(475-599) 562(472-641) IEF & SV 61.

**Natrix trianguligera 117.8** 607(405-956 in 23) 715(367-912 in 19) FK 41.

*Nerodia cyclopion* 124 626-900 660-1250 AHW & AAW 57.

*Nerodia erythrogaster bogerti* 107 618(539-708 in 4) 663(583-794 in 6) RC 69.

**Nerodia erythrogaster transversa 115** 686.2 (630-750 in 10) 786.8(664-966 in 10) RC 69.

*Nerodia fasciata* 116 600-1090 660-1300 AHW & AAW 57.

*Nerodia fasciata confluens* 132 410-658 500-910 AHW & AAW 57.

*Nerodia fasciata pictiventris* 152 425-818 700-1195 AHW & AAW 57.

**Nerodia rhombifera 111** 772.0(695-862 in 10) 859.7(774-1015 in 10) RC 69.

**Nerodia rhombifera blanchardi 120** 714.8(683-780 in 10) 854.6(692-1068 in 10) RC 69.

**Nerodia rhombifera werleri 162** 676.5(529-791 in 10) 1093(956-1162 in 10) RC 69.

**Nerodia sipedon 132.4** 551.2(413-748 in 55) 729.7(570-1025 in 46) HSF*.

*Nerodia sipedon insularum* 108 685-900 562-1151 AHW & AAW 57.

*Nerodia sipedon pleuralis* 124 670-1100 710-1350 AHW & AAW 57.

*Nerodia taxispilota* 117 670-1100 710-1350 AHW & AAW 57.

**Nerodia valida 135** 545.4(513-579 in 10) 738.5 (694-867 in 10) RC 69.

**Nerodia valida celaeno 109** 613.4(556-712 in 10) 671.1(608-730 in 10) RC 69.

**Nerodia valida isabelleae 142** 417.3(379-479 in 10) 591.4(531-707 in 10) RC 69.

**Nerodia valida thamnophisoides 121** 452.8(425-500 in 10) 547.2(476-672 in 10) RC 69.

**Neusticurus bicarinatus 85** 100(90-117 in 19) 85(79-96 in 15) MSH 73.

**Neusticurus ecpleopus 93.0** 61(52.5-72 in 66) 56.6(53.5-60 in 23) WCS 75.

*Ninia maculata* 107.2 202.6(187-231 in 18) 217.4(187-233 in 7) HSF*.

**Notechis scutatus 98.9** 81.6 in 174 80.8 in 32 RS 77.

*Opheodrys aestivus* 100 345-379 335-805 AHW & AAW 57.

*Opheodrys major* 83.4 750.5(650-930 in 4) 626(610-678 in 4) *var.*

*Opheodrys vernalis* 101 332(304-358 in 6) 335(301-378 in 7) HMS 63.

*Ophiomorus persicus* 119 64.6(56-72 in 7) 77.1 (73-82 in 9) SCA & AEL 66.

*Ophiomorus rathmai* 112 77.7(64-85 in 7) 86 (63-99 in 11) SCA & AEL 66.

*Ophiomorus tridactylus* 103 82(71-91 in 9) 84.6(76-88 in 6) SCA & AEL 66.

**Ophisaurus attenuatus 95.2** 226.6(200-285 in 733) 215.6(195-263 in 420) HSF*.

*Oxybelis argenteus* 125 576(447-774 in 8) 724 (630-806 in 11) WED ms.

**Oxyrhopus melanogenys 115.2** 588(540-696 in 16) 677(605-755 in 18) HSF*.

**Oxyrhopus petola 117.6** 662.2(608-758 in 13) 779.3(700-857 in 14) HSF*.

**Pareas carinatus 99.6** 387.9(339-454 in 20) 386(332-460 in 20) FK 41.

**Pelamis platurus 118** 563(518-621 in 30) 664 (627-738 in 30) CK 75.

**Peropus mutilatus 99** 53.3(52.4-54.0 in 70) 52.8(52.5-53.0 in 98) GC 62.

*Philothamnus hoplogaster* 120.1 417.5(335-690 in 6) 501(398-655 in 4) *var.*

*Philothamnus irregularis* 133 601.6(499-730 in 8) 802.5(646-1070 in 6) *var.*

*Philothamnus semivariegatus* 103.2 650.4(534-800 in 9) 671(435-850 in 11) *var.*

*Phrynocephalus scutellatus* 105.2 (42.5-48.0) (40.5-50.5) AEL 59.

**Phrynosoma cornutum 106.6** 69.6(64-75 in 15) 74.4(65-82 in 17) HSF*.

*Phrynosoma coronatum* 101.5 82.5(71-90 in 6) 83.6(74-96 in 5) HSF*.

**Phrynosoma douglassi 109.7** 60.9(39-88 in 11) 66.9(28-94 in 23) WWT & BHB 66.

*Phrynosoma modestum* 112.2 55.8(51-66 in 6) 62.8(55-71 in 10) HSF*.

*Phrynosoma orbiculare* 103 73.5(64-86 in 8) 75.7(68-90 in 15) HSF*.

**Phrynosoma platyrhinos 106.2** 71.5(65-75 in 24) 76(65-80 in 32) ERP & WSP 75.

**Phrynosoma solare 108** 90.4(80-100 in 19) 98 (80-110 in 22) WSP 71.

**Phyllodactylus angustidigitatis 95.1** 50.3(41-57) 47.8(37-54) in 246 JRD & RBH 70.

*Phyllodactylus europaeus* 97.5 40.8(40-44 in 4) 39.8(38-42 in 5) SB 68.

**Phyllodactylus gerrhopygus 97.5** 43.9(32-56) 42.8(32-55) in 98 JRD & RBH 70.

**Phyllodactylus inaequalis 99.5** 37.0(33-40) 36.8 (30-42) in 59 JRD & RBH 70.

**Phyllodactylus interandinus 104.9** 39.2(32-45) 41.1(33-47) in 149 JRD & RBH 70.

**Phyllodactylus johnwrighti 103** 37.9(32-40) 39.0(33-44) in 41 JRD & RBH 70.

**Phyllodactylus kofordi 101.7** 38.0(30-45) 38.6 (30-46) in 167 JRD & RBH 70.

**Phyllodactylus lepidopygus 114.7** 40.8(32-50) 46.8(36-55) in 63 JRD & RBH 70.

**Phyllodactylus microphyllus 99.8** 46.7(33-56) 46.5(32-58) in 277 JRD & RBH 70.

**Phyllodactylus reissi 97.0** 59.4(42-75) 57.5(37-73) in 772 JRD & RBH 70.

*Phyllodactylus tuberculosus* 102 72.5(54-80) 76.6(72-83) GAH & JRL 67.

**Phyllodactylus ventralis 99.8** 62.4(50-74) 62.3 (52-75) in 22 JRD & RBH 70.

*Phyllorhynchus decurtatus nubilus* 110 300-343 in 50 300-408 in 33 AHW & AAW 57.

**Phyllorhynchus decurtatus perkinsi 97** 340 in 214 330 in 148 AHW & AAW 57.

**Pituophis melanoleucus affinis 104** 676 in 31 698 in 23 AHW & AAW 57.

*Pituophis melanoleucus catenifer* 95 1060(760-1360) 1010(750-1270) AHW & AAW 57.

**Pituophis melanoleucus deserticola 91** 910.5 in 23 826.2 in 13 AHW & AAW 57.

**Pituophis melanoleucus sayi 101.0** 1246(1015-1779 in 59) 1258(1005-1624 in 55) HSF*.

**Plica plica 100** 90-140 83-143 RE 70.

*Plica umbra* 90.5 (72-100 in 15) (61-94 in 14) RE 70.
*Plica umbra ochrocollaris* 102.8 78.5(66-89 in 16) 80.6(69-90 in 12) WED ms.
*Polychrus marmoratus* 124 385 in 9 478 in 13 WB 44.
**Prionodactylus argulus 99.5** 38.0(30-42 in 14) 37.8(32-47 in 25) WED ms.
*Prionodactylus manicatus* 122.8 51.3(41-65 in 6) 63(55-70 in 5) WED ms.
**Proctoporus bolivianus 106** 50.0(46-61 in 10) 53.0(46-61 in 10) HSF*.
*Prosymna ambigua* 117 234(202-250 in 4) 274 (216-366 in 4) *var.*
*Psammodynastes pulverulentus* 109 374(335-426 in 9) 407(352-485 in 12) FK 41.
*Psammophis schokari* 77.4 664(614-737 in 10) 513(443-600 in 5) HM 58.
**Psammophis sibilans 81.9** 886(708-1215 in 19) 725(516-1253 in 18) *var.*
*Psammophylax tritaeniatus* 93 622.7(525-734 in 8) 579(467-851 in 10) *var.*
**Pseudechis porphyriaca 95.4** 1116 in 225 1061 in 55 RS 77.
*Pseudemys concinna* 117 145 170 RBB 79.
**Pseudemys floridana 138.5** 164(110-200 in 11) 227.5(200-260 in 16) JWG & JWC 77.
*Pseudemys floridana "suwanensis"* 143 150-270 in 208 240-360 in 232 AC 52.
*Pseudemys rubriventris* 116 257(212-277 in 4) 299(281-322.5 in 9) AEC 52; TEG 71.
**Pseudemys scripta 140** 217(137-340 in 98) 304 (248-349 in 48) EOM & JML 71.
*Pseudemys scripta troosti* 108 140-210 in 9 172-206 in 6 AC 52.
*Pseudocerastes fieldi* 108 575 in 8 623 in 7 HM 65.
*Pseudogonatodes guianensis* 102 25.2(23-26 in 8) 25.5(23-27 in 8) WED ms.
*Ptenopus garrulus* 101.1 45.6(33.0-48.0 in 5) 46.1(32.5-49.5 in 4) *var.*
**Ptyas korros 92.2** 1021(771-1227 in 15) 940 (793-1055 in 19) FK 41.
**Ptyas mucosus 93.8** 1300(1120-1490 in 10) 1220(1050-1507 in 14) FK 41.
*Ptychoglossus brevifrontalis* 111 (40-46) (42-53) in 10 JRD & PS 75.

*Regina alleni* 106 401-600 401-652 AHW & AAW 57.
**Regina grahami 119.5** 478(340-620 in 36) 571 (430-760 in 33) RJH 69.
*Regina rigida* 134 350-546 493-705 AHW & AAW 57.
**Regina septemvittata 114.1** 395 in 68 451 in 58 JTW & WED 50.
**Rhabdophis chrysarga 106** 473(417-590 in 94) 500(420-643 in 110) CPJH 41.
**Rhabdophis subminiata 122** 388(352-445 in 43) 467(430-529 in 47) CPJH 41.
*Rhabdophis tigrina* 120 600-900 700-1100 HF 65.
**Rhadinea flavilata 111.5** 205 in 46 229 in 45 CWM 74.
*Rhamphiophis acutus* 86.5 651.2(549-826 in 4) 564(400-729 in 4) *var.*
*Rhinocheilus lecontei* 87 498-936 536-820 AHW & AAW 57.
*Rhinocheilus lecontei clarus* 91 642 in 29 586 in 13 AHW & AAW 57.
*Rhinoclemys pulcherrima incisa* 117 153 in 5 179 in 5 HH ms.

*Salvadora hexalepis* 90 684-1014 709-826 AHW & AAW 57.
*Salvadora hexalepis mojavensis* 84 800-941 650-803 AHW & AAW 57.
*Salvadora hexalepis virgultea* 91 678-1027 625-892 AHW & AAW 57.
**Salvadora lemniscata 97.4** 1460 in 10 1423 in 10 CMB 39.
**Salvadora mexicana 87** 1246 in 10 1083 in 10 CMB 39.
**Sauromalus obesus 92** 175(162-197 in 25) 161 (149-184 in 28) SRJ 65.
**Sceloporus adleri 92** 65.3(59-72 in 14) 60.4 (54-66 in 14) HSF 78.
**Sceloporus bulleri 97** 100.7(95-116 in 10) 97.7 (91-108 in 10) HSF 78.
**Sceloporus chrysostictus 95** 54.0(45-62 in 81) 51.3(44-61 in 82) HSF 78.
**Sceloporus clarki 92** 102.1(97-118 in 29) 94.9 (88-107 in 21) HSF 78.
**Sceloporus clarki boulengeri 81** 104(91-138 in 27) 84.1(72-120 in 36) HSF 78.
**Sceloporus cozumelae 87** 50.7(43-60 in 57) 45.5(41-57 in 33) HSF 78.
*Sceloporus cyanogenys* 105 100.7(86-116 in 8) 105.9(88-119 in 22) HSF 78.
*Sceloporus formosus* 103 71.6(64-80 in 12) 73.9(68-80 in 8) HSF 78.
**Sceloporus graciosus 104** 57.4(52-63 in 106) 59.9(53-69 in 121) HSF 78.
**Sceloporus graciosus "gracilis" 103** 52.1(49-61 in 85) 53.9(48-63 in 76) HSF 78.
**Sceloporus graciosus vandenburgianus 95** 60.2 (55-65 in 34) 57.5(51-63 in 26) HSF 78.
**Sceloporus grammicus 96** 51.2(42-57 in 23) 49.3(44-54 in 32) HSF 78.
**Sceloporus insignis 92** 89.5(80-99 in 10) 82.6 (80-89 in 10) HSF 78.
**Sceloporus jarrovi 91** 78.8(61-91 in 35) 71.88 (57-86 in 33) HSF 78.
*Sceloporus lundelli* 105 90.0(86-93 in 4) 94.7 (91-99 in 6) HSF 78.
**Sceloporus magister 84** 115.5(80-140 in 42) 96.6(80-120 in 33) HSF 78.
**Sceloporus malachiticus 95** 79.1(67-90 in 146) 75.5(64-86 in 208) HSF 78.
**Sceloporus megalepidurus 99** 45.2(42-50 in 10) 44.9(41-48 in 11) HSF 78.
**Sceloporus merriami 95** 52.3(45-61 in 60) 49.8 (44-55 in 51) HSF 78.
**Sceloporus merriami annulatus 95** 47.7(42-53 in 96) 45.3(39-50 in 62) HSF 78.

**Sceloporus mucronatus 95** 93.3(85-100 in 21) 88.5(81-100 in 17) HSF 78.

**Sceloporus nelsoni 87** 60.1(53-65 in 26) 52.1 (48-58 in 21) HSF 78.

**Sceloporus occidentalis 106** 66.1(61-72 in 23) 70.4(68-77 in 13) HSF 78.

**Sceloporus occidentalis biseriatus 107** 73.6(65-81 in 14) 82.7(72-87 in 21) HSF 78.

**Sceloporus olivaceus 111** 82.9(60-93 in 34) 93.0(63-107 in 107) HSF 78.

**Sceloporus orcuttii 90** 102(90-115 in 17) 92 (85-106 in 77) HSF 78.

*Sceloporus pictus* 98 48.9(47-51 in 8) 47.9 (44-52 in 7) HSF 78.

**Sceloporus poinsetti 86** 116.4(100-130 in 18) 97.0(86-116 in 21) HSF 78.

*Sceloporus pyrocephalus* 85 62.9(58-68 in 9) 53.5(49-60 in 12) HSF 78.

**Sceloporus scalaris 111** 45.3(40-55 in 45) 51.3 (40-60 in 203) HSF 78.

**Sceloporus scalaris aeneus 99** 46.1(42-49 in 10) 45.5(41-53 in 23) HSF 78.

**Sceloporus scalaris bicanthalis 106** 45.4(43-50 in 14) 48.8(42-55 in 11) HSF 78.

**Sceloporus siniferus 86** 60.8(53-67 in 32) 52.3 (48-61 in 35) HSF 78.

**Sceloporus smaragdinus 93** 67.2(60-80 in 14) 62.2(55-77 in 17) HSF 78.

**Sceloporus spinosus 99** 88.3(82-99 in 17) 87.2 (77-96 in 18) HSF 78.

**Sceloporus taeniocnemis 97** 71.1(65-81 in 19) 68.7(60-82 in 20) HSF 78.

**Sceloporus teapensis 93** 58.9(46-64 in 24) 52.0 (47-62 in 26) HSF 78.

*Sceloporus torquatus* 99 103.5(98-118 in 13) 102.7(97-110 in 9) HSF 78.

**Sceloporus undulatus 110** 56.1(47-65 in 59) 62.1(53-70 in 35) HSF 78.

**Sceloporus undulatus consobrinus 101** 60.3(55-74 in 45) 61.0(55-71 in 46) HSF 78.

**Sceloporus undulatus elongatus 112** 63.1(55-71 in 20) 72.0(65-83 in 20) HSF 78.

**Sceloporus undulatus erythrocheilus 110** 59.5 (53-65 in 21) 66.2(60-72 in 21) HSF 78.

**Sceloporus undulatus garmani 107** 52.2(45-59 in 62) 56.3(53-68 in 44) HSF 78.

**Sceloporus undulatus hyacinthinus 107** 59.8 (57-63 in 18) 64.2(57-67 in 11) HSF 78.

**Sceloporus undulatus tristichus 107** 58.6(52-70 in 33) 62.8(57-75 in 53) HSF 78.

*Sceloporus utiformis* 93 64.4(58-75 in 9) 59.7 (51-66 in 10) HSF 78.

**Sceloporus variabilis 81** 65.8(57-74 in 97) 53.1 (44-68 in 157) HSF 78.

**Sceloporus virgatus 112** 52.0(48-58 in 11) 58.8 (51-69 in 11) HSF 78.

**Sceloporus woodi 106** 47.6 50.5 HSF 78.

**Scincella lateralis 105.3** 45.4(43-50 in 14) 47.8 (42-56 in 22) HSF*.

*Scincus mitratus* 79.1 126(121-134 in 4) 99.7 (92-105 in 5) ENA & AEL 77.

**Scincus scincus 85.2** 116(88-139 in 27) 99(83-115 in 29) ENA & AEL 77.

**Seminatrix pygaea 110** 303.3(275-336 in 20) 330.3(285-415 in 20) HGD 50.

**Sistrurus catenatus 92** 663 in 10 610 in 10 LMK 37.

*Sistrurus ravus exiguus* 76 587-664 in 13 413-481 in 4 JAC & BLA 79.

**Sonora episcopa 99.7** 213.5(181-258 in 20) 213.1(180-245 in 16) HSF*.

*Sonora michoacanensis* 104.1 234.4(205-275 in 5) 244(234-272 in 6) ACE 73.

**Sonora semiannulata 99** 211 in 43 209 in 57 AHW & AAW 57.

**Spalerosophis cliffordi 107** 1009(725-1265 in 164) 1165(780-1520 in 205) RD 67.

**Sphaerodactylus argivus 99.3** 25.4(22-29 in 82) 25.2(21-29 in 106) RT 75.

**Sphaerodactylus argus 113** 29.1(26-33 in 65) 32.5(28-33 in 71) RT 75.

**Sphaerodactylus argus barstchi 105.8** 25.8(20-29 in 30) 27.3(24-29 in 17) RT 75.

**Sphaerodactylus lewisi 107.5** 24.5(22-27 in 12) 26.4(24-27 in 15) RT 75.

**Sphaerodactylus oxyrhinus 111.2** 30.9(28-33 in 12) 34.4(29-34 in 14) RT 75.

**Sphaerodactylus oxyrhinus dacnicolor 101.5** 29.8(27-32 in 28) 30.3(27-32 in 30) RT 75.

**Sphaerodactylus semasiops 110** 25.4(23-30 in 10) 28.0(24-31 in 16) RT 75.

**Sphenomorphus cherriei 99.8** 54.7(50-58 in 39) 54.6(49-63 in 61) HSF*.

**Sternotherus carinatus 98** 105(84-116 in 18) 103(82-117 in 13) YM 67.

**Sternotherus minor 105** 82.3 in 310 86.3 in 341 JBI 77.

**Sternotherus odoratus 105** 73.7(64-85 in 18) 77.5(66-84 in 16) YM 67.

*Stilosoma extenuatum* 104 270-567 300-575 AHW & AAW 57.

**Storeria dekayi texanum 120.2** 203.8(167-244 in 13) 245.0(201-309 in 18) HSF*.

**Storeria dekayi victa 119.8** 191(175-290 in 34) 227(175-412 in 22) HT 44.

**Storeria occipitomaculata 118.4** 168.5(141-203 in 14) 199.5(177-272 in 15) HSF*.

*Tachymenis chilensis assimilis* 87 306 267 WFW 45.

*Tachymenis chilensis melanura* 106 350 372 WFW 45.

**Tachymenis peruviana 93** 333 309 WFW 45.

**Tantilla gracilis 125.7** 141.4(121-165 in 43) 177.9(120-209 in 21) HSF*.

*Tantilla planiceps* 94 277-375 211-373 AHW & AAW 57.

**Tarentola mauritanica 84** 62.7±2.3 52.7±1.1 JR & PB 71.

*Telescopus semiannulatus* 128.2 615.5(478-760 in 4) 790.2(522-953 in 4) *var.*

*Terrapene carolina* 90.9 140.1(128-154 in 8) 127.4(109-142 in 9) WED & AS 58.

**Terrapene coahuila 92.5** 108.9 in 70 100.9 in 94 WSB 71.

**Terrapene ornata 101.8** 111.6(100-126 in 75) 113.5(101-130 in 163) HSF*.

*Testudo graeca* 97 208.7(145-270) 203.2 IEF & SV 61.

*Thamnophis brachystoma* 112 290-440 290-506 AHW & AAW 57.

**Thamnophis butleri 109** 338(310-410 in 92) 369(310-480 in 60) CCC 52.

*Thamnophis couchi* 132 430-580 440-900 AHW & AAW 57.

*Thamnophis couchi gigas* 134 500-740 550-1080 AHW & AAW 57.

*Thamnophis couchi hammondi* 136 373-729 388-989 AHW & AAW 57.

*Thamnophis couchi hydrophilus* 130 330-580 350-610 AHW & AAW 57.

*Thamnophis cyrtopsis* 146 429-470 504-764 AHW & AAW 57.

*Thamnophis elegans* 118 370-590 420-690 AHW & AAW 57.

*Thamnophis elegans biscutatus* 138 490-797 570-922 AHW & AAW 57.

*Thamnophis elegans terrestris* 106 308-604 380-590 AHW & AAW 57.

**Thamnophis elegans vagrans 122** 453(290-580 in 35) 586(470-730 in 36) HSF 40.

*Thamnophis eques* 115 412(321-489 in 6) 498 (407-518 in 6) *var.*

*Thamnophis marcianus* 126 335-621 322-887 AHW & AAW 57.

**Thamnophis ordinoides 125** 328(250-500 in 151) 410(280-550 in 125) HSF 40.

**Thamnophis proximus 109.5** 489.6(420-600 in 13) 536.5(445-760 in 31) HSF*.

*Thamnophis radix* 108 325-650 350-700 AHW & AAW 57.

**Thamnophis sauritus 117.5** 410(360-540 in 115) 483(360-610 in 158) CCC 52.

**Thamnophis sirtalis 114** 453(390-600 in 240) 515(390-720 in 235) CCC 52.

**Thamnophis sirtalis parietalis 123** 519(412-683 in 215) 636(510-968 in 282) HSF*.

**Thamnophis sirtalis pickeringi 124** 471.4±10.84 584.40±13.10 WBH 36.

*Thecadactylus rapicaudus* 106 101(93-108 in 5) 107(97-116 in 6) WED ms.

*Thelotornis capensis* 100 945(757-1312 in 5) 942(670-1366 in 5) *var.*

*Thrasops jacksoni* 125.5 1322(1300-1330 in 5) 1661(1263-1550 in 6) *var.*

**Tretanorhinus nigroluteus 141** 423 in 23 597 in 18 RWH & LGH 79.

**Tretioscincus agilis 107** 37.9(33-48 in 70) 40.7 (35-48 in 53) PEV & RR 69.

*Trimeresurus albolabris* 161 468(438-485 in 5) 751(710-786 in 5) CHP 35.

**Trimeresurus flavoviridis 89.3** 1035(720-1370 in 24) 925(530-1370 in 22) KM 79.

**Trimeresurus okinavensis 99** 517(300-676 in 20) 511(310-700 in 21) KM 79.

*Trimeresurus puniceus* 138.7 429(360-499 in 4) 595(527-656 in 4) FK 41.

*Trimeresurus stejnegeri* 109.1 631.5(592-670 in 4) 690.8(625-731 in 4) CHP 35.

*Trimorphodon biscutatus lambda* 130 296-788 359-1026 AHW & AAW 57.

*Trimorphodon biscutatus vandenburghi* 127 555-738 556-1054 AHW & AAW 57.

**Trionyx muticus 157.5** 98.1(80-120 in 1105) 154.5(140-180 in 164) MVP 77.

*Trionyx spiniferus emoryi* 236 80-90 200 RBB 79.

**Trionyx spiniferus ferox 168** 155(114-190 in 73) 286(165-395 in 98) WJB 55.

*Trionyx spiniferus pallidus* 182 90-100 160-185 RBB 79.

*Trogonophis wiegmanni* 98 179(165-196 in 6) 175(170-185 in 6) JB & HStG 63.

**Tropidoclonion lineatum 122.2** 215.1(183-247 in 19) 262.8(216-341 in 40) HSF*.

**Tropidurus albemarlensis 79** 82(65-95 in 67) 65(45-75 in 118) CCC 70.

**Tropidurus albemarlensis barringtonensis 84** 94(75-125 in 49) 79(55-85 in 31) CCC 70.

**Tropidurus bivittatus 78** 81(65-105 in 27) 63 (45-95 in 26) CCC 70.

**Tropidurus delanonis 76** 119(115-155 in 41) 90(85-115 in 43) CCC 70.

**Tropidurus duncanensis 89** 87(55-105 in 17) 77(55-85 in 32) CCC 70.

**Tropidurus grayi 116** 70.3(55-95 in 42) 81.4 (45-85 in 17) CCC 70.

**Tropidurus habeli 79** 107.1(95-115 in 23) 84.6 (75-95 in 27) CCC 70.

**Tropidurus icae 86.7** 85.6(77-94) 74.2(70-76) JRD & JWW 75.

**Tropidurus occipitalis 81** 64.4(50-75) 52.2(47-58) JRD & JWW 75.

**Tropidurus pacificus 87** 87.5(65-105 in 17) 75.7 (65-85 in 32) CCC 70.

**Tropidurus peruvianus 86** 98.3(90-103) 84.6 (78-97) JRD & JWW 75.

**Tropidurus salinicola 92** 62.3(51-72) 57.1(50-64) JRD & JWW 75.

**Tropidurus stolzmanni 71.3** 80.3(52-106) 57.4 (48-68) JRD & JWW 75.

**Tropidurus talarae 77.8** 81.6(77-84) 63.4(60-70) JRD & JWW 75.

**Tropidurus thoracicus 87** 68.5(63-74) 62(48-76) JRD & JWW 75.

*Tropidurus torquatus* 80 109.8(97.8-121.7 in 11) 88.1(79.5-98.5 in 7) RV & BSD 60.

**Typhlosaurus garipensis 105.5** 116.1±.78 in 37 122.9±.77 in 35 RBH & ERP 74.

**Typhlosaurus lineatus 105** 130.5±.64 in 133 137.3±.75 in 93 RBH & ERP 74.

**Typhlops angolensis adolfi 124.5** 377(281-534 in 11) 469.4(380-602 in 10) RFL 56.

*Typhlops angolensis dubius* 136.2 433(316-547 in 10) 591.7(464-703 in 6) RFL 56.

*Typhlops angolensis iraci* 141 396.5(312-532 in 4) 559(500-630 in 10) RFL 56.

**Uma inornata 79.4** 102(80-122 in 191) 81(70-99 in 213) WWM 65.

**Uma notata 79** 96(80-121 in 270) 76(70-94 in 214) WWM 66B.
**Uma scoparia 85.6** 97(80-113 in 248) 83(70-112 in 236) WWM 66A.
*Uracentron flaviceps* 70.4 49.8(42-58 in 4) 35.0 (30-42 in 5) CMF & TDS 68.
**Urechis gouldi 83.4** 36.2 in 129 30.2 in 29 RS 77.
**Urosaurus ornata 97.3** 49.6(41-64 in 178) 48.3 (40-62 in 129) HSF*.
**Uta antigua 92** 50.8±1.3 in 33 46.6±.90 in 27 AED, DWT & JWG 78.
**Uta mearnsi 96** 77.0(66-84 in 38) 73.9(132-172 in 50) MLH 65.
**Uta nolascensis 93** 50.05±1.07 in 21 46.6±.83 in 15 AED, DWT & JWG 78.
**Uta palmeri 91** 66.97±2.82 in 34 60.7±1.36 in 51 AED, DWT & JWG 78.
**Uta squamata 93** 50.6±1.03 in 25 47.1±.66 in 27 AED, DWT & JWG 78.
**Uta stansburiana 87** (43-57 in 447) (40-56 in 402) HSF*.

*Varanus acanthurus* 86.6 170(153-192 in 6) 147.5(133-163 in 4) RM 58.
**Vermicella annulata 139** 392(282-534 in 84) 544(325-746 in 80) RS 80A.
*Vipera ammodytes* 118 (52-80) (61-95) SB 67B.
*Vipera berus* 108 462.5 in 100 498 in 127 IP 71.
*Vipera latastei* 90.1 333(270-400 in 12) 290 (250-340 in 6) HSG 73.
*Vipera ursini* 110 390 430 SB 67.
**Vipera xanthina 95** 937(810-1073 in 21) 894 (831-1100 in 33) HM 65.
**Virginia striatula 115.7** 180.8(182-200 in 90) 209.1(182-236 in 55) DRC 64.
**Virginia valeriae 124.4** 169.8(133-189 in 10) 211.3(190-240 in 15) HSF*.

**Xantusia henshawi 110.7** 56 62 JCL 75.
*Xenochrophis cerasogaster* 152.8 441.8(390-498 in 4) 673.2(480-754 in 4) EVM & SAM 65; MAS 43.
**Xenochrophis piscator 134.8** 423.8(300-570 in 20) 571.4(326-842 in 40) FK 41.
**Xenochrophis vittata 123.9** 327(263-386 in 12) 405(303-483 in 14) FK 41.
**Xenodermus javanicus 111** 345(316-418 in 15) 383(314-440 in 24) FK 41.
**Xenodon severus 96.1** 905(710-1325 in 19) 870(710-1129 in 15) HSF*.

# APPENDIX II

## Maximum sizes (snout-vent) of reptiles recorded by various authors

Symbol(s) after each name represent(s) degree of size difference between the sexes (see p. 4); these are followed by male length and female length in millimeters, initials of authority, and year of publication.

*Ablepharus smithi* X 41, 42, GFW 53
*Acrochordus javanicus* ++++ 900, 1515, MAS 43
*Agama atra* —— 135, 108, VFMF 43
*Agama cyanogaster* —— 167, 127, AEL 53
*Agama hispida aculeata* — 110, 103, VFMF 43
*Agama kirki* — 105, 92, AEL 53
*Agama mossambica* ——— 93, 70, VFMF 43
*Agama planiceps* — 112, 102, VFMF 43
*Agkistrodon acutus* + 1130, 1250, CHP 35
*Agkistrodon blomhoffi brevicaudus* X 620, 598, HKG 77
*Agkistrodon blomhoffi siniticus* X 588, 608, HKG 77
*Agkistrodon caliginosus* X 521, 520, HKG 77
*Agkistrodon halys cognatus* — 590, 518, HKG 77
*Agkistrodon himalayanus* X 505, 520, MAS 43
*Agkistrodon rhodostoma* +++ 545, 765, MAS 43
*Agkistrodon saxatilis* — 689, 613, MAS 43
*Ahaetulla nasuta* ++++ 795, 1220, MAS 43
*Ahaetulla pulverulenta* ++++ 655, 1020, MAS 43
*Amblyodipsas polylepis* ++++ 495, 1040, DGB & EVC 75
*Amblyodipsas ventrimaculatus* ++ 290, 340, DGB & EVC 75
*Ameiva chaitzami* — 85, 75, ACE 71
*Ameiva undulata amphigramma* X 101, 104, HMS & LEL 46
*Ameiva undulata gaigeae* —— 125, 107, HMS & LEL 46
*Ameiva undulata hartwegi* —— 138, 115, HMS & LEL 46
*Ameiva undulata parva* — 109, 95, HMS & LEL 46
*Ameiva undulata podarga* —— 116, 96, HMS & LEL 46
*Amphiesma beddomei* ++ 385, 480, MAS 43
*Amphiesma craspedogaster* + 435, 490, MAS 43
*Amphiesma khasiensis* + 375, 410, MAS 43
*Amphiesma modesta* +++ 365, 460, MAS 43
*Amphiesma monticola* ++ 262, 325, MAS 43
*Amphiesma platyceps* — 655, 570, EVM 66
*Amphiesma popei* X 438, 446, EVM 66
*Amphiesma pryeri* ++ 607, 710, EVM 66
*Amphiesma sieboldi* +++ 729, 943, EVM 66
*Amphiesma venningi* + 410, 455, MAS 43
*Amphiesma vibakari* X 551, 580, MAS 43
*Amphiesma xenura* X 440, 430, MAS 43
*Anguis fragilis* + 212, 232, *var.*
*Anilius scytale* ++++ 810, 1184, JRD & PS 77
*Anolis ahli* ——— 58, 45, RR & EEW 61
*Anolis alumina* — 40, 37, PEH 76
*Anolis bahorucoensis southerlandi* —— 51, 44, AS 78
*Anolis baleatus* —— 180, 148, AS 74
*Anolis baleatus litorisilva* —— 158, 131, AS 74
*Anolis baleatus multistruppus* — 150, 141, AS 74
*Anolis baleatus scelestus* —— 180, 147, AS 74
*Anolis barkeri* —— 98, 79, JPK 65
*Anolis baronhae* — 158, 148, AS 74
*Anolis dolichocephalus sarmenticola* —— 51, 42, AS 78
*Anolis dolichocephalus portusalus* —— 52, 43, AS 78
*Anolis extremus* —— 74, 60, EEW 72
*Anolis hendersoni ravidormitans* — 49, 42, AS 78
*Anolis homolechis cuneus* ——— 58, 41, AS 68
*Anolis homolechis jubar* ——— 54, 40, AS 68
*Anolis homolechis oriens* ——— 56, 42, AS 68
*Anolis homolechis quadriocellifer* ——— 55, 40, AS 68
*Anolis lividus* —— 69, 55, EEW 72
*Anolis luciae* ——— 91, 62, EEW 72
*Anolis mestrei* ——— 55, 44, RR & EEW 61
*Anolis monticola* ——— 56, 42, EEW 74
*Anolis nubilus* ——— 79, 52, EEW 72
*Anolis oculatus* ——— 75, 55, EEW 72
*Anolis oculatus cabritensis* —— 75, 57, EEW 72
*Anolis oculatus montanus* ——— 95, 64, EEW 72
*Anolis oculatus winstoni* —— 77, 61, EEW 72
*Anolis petersi* + 102, 108, HSF 76
*Anolis ricordi subsolans* X 152, 150, AS 74
*Anolis ricordi viculus* — 148, 141, AS 74
*Anolis rubribarbis* ——— 58, 42, RR & EEW 61
*Anolis rupinae* ——— 56, 42, EEW & IPW 74
*Anolis sabanus* —— 67, 51, EEW 72
*Aparallactus capensis* + 235, 268 DGB & EVC 75
*Aparallactus guentheri* + 345, 380, DGB & EVC 75
*Aparallactus jacksoni* X 228, 213, CRSP 74
*Aparallactus ubangensis* ++ 375, 412, GW & AL 47
*Aparallactus ulugurensis* X 320, 335, GW & RL 47
*Argyrogena fasciolata* X 765, 790, MAS 43

*Arizona elegans* X 1168, 1165, LMK 46
*Aristelliger georgeensis* —— 108, 83, AS & RIC 75
*Aristelliger hechti* —— 90, 75, AS & RIC 75
*Aristelliger lar* —— 132, 111, AS & RIC 75
*Aristelliger praesignis* —— 85, 65, AS & RIC 75
*Arrhyton dolichurum* — 308, 265, AS 65
*Arrhyton taeniatum* + 401, 448, AS 65
*Arrhyton vittatum* — 193, 179, AS 65
*Arrhyton vittatum landoi* + 236, 250, AS 65
*Aspidelaps scutatus* + 590, 640, DGB & EVC 75
*Aspidura copei* + 340, 365, MAS 43
*Aspidura trachyprocta* ++++ 350, 505, MAS 43
*Astrotia stokesii* +++ 1030, 1410, MAS 43
*Atractaspis congica* — 441, 400, RL 50
*Atractaspis dahomeyensis* + 417, 458, RL 50
*Atractaspis microlepidotus* —— 690, 525, RL 50
*Atractaspis microlepidotus fallax* X 680, 705, RL 50
*Atractaspis microlepidotus micropholis* —— 690, 525, RL 50
*Atractus* "species A" + 395, 425, JRD & PS 77
*Atractus badius* ++ 342, 413, JRD & PS 77
*Atractus latifrons* +++ 446, 586, JRD & PS 77
*Atractus resplendens* + 333, 372, JMS 60
*Atractus roulei* ++ 330, 396, JMS 60
*Atheris nitschei* ++ 523, 616, CRSP 74

*Balanophis ceylonensis* — 390, 365, MAS 43
*Bitis atropos* + 397, 434, VFMF 62
*Bitis caudalis* X 417, 399, VFMF 62
*Bitis cornuta* —— 347, 271, VFMF 62
*Bitis gabonica* ++ 990, 1219, KPS 23
*Bitis nasicornis* +++ 812, 966, KPS 23
*Bitis paucisquamata* + 218, 234, VFMF 62
*Bitis peringueyi* ++ 245, 297, RM 55
*Blythia reticulata* +++ 275, 365, MAS 43
*Boaedon fuliginosa* ++++ 519, 810, CRSP 74
*Boaedon olivaceus* X 596, 596, CRSP 74
*Boiga blandingii* + 1635, 1833, CRSP 74
*Boiga ceylonensis* +++ 780, 1095, MAS 43
*Boiga cyanea* +++ 1060, 1420, MAS 43
*Boiga cynodon* ++ 1110, 1310, MAS 43
*Boiga forsteni* — 1460, 1260, MAS 43
*Boiga gokool* + 630, 695, MAS 43
*Boiga multimaculata* +++ 610, 800, MAS 43
*Boiga ochracea* + 815, 885, MAS 43
*Boiga trigonata* ++ 685, 810, MAS 43
*Bothrops bilineatus* +++ 490, 638, JRD & PS 77
*Bothrops neuwiedii* X 779, 800, RV & BSS 60
*Bungarus bungaroides* ——— 1240, 870, MAS 43
*Bungarus candidus* — 1225, 1080, FK 41
*Bungarus fasciatus* — 1005, 901, FK 41
*Bungarus multicinctus* — 960, 825, CHP 35
*Bungarus walli* — 1450, 1310, MAS 43

*Calamaria leucogaster* + 196, 207, RFI & HM 65
*Calamaria linnaei* ++ 308, 379, RFI & HM 65
*Calamaria modesta* ++ 366, 428, RFI & HM 65
*Calamaria septentrionalis* ++ 319, 371, RFI & HM 65
*Calamaria uniformis* + 281, 320, MAS 43
*Calliophis calligaster* — 519, 476, AEL 63
*Calliophis calligaster gemianulus* — 519, 451, AEL 63
*Calliophis japonicus* —— 533, 435, KK, DK, TF & KT 77
*Calliophis macllelandi* +++ 565, 720, MAS 43
*Calliophis maculiceps* ++ 385, 447, MAS 43
*Callopistes maculatus* — 173, 148, RDB 66
*Calotes versicolor* — 95, 82.5, MAS 35
*Candoia aspersa* ++++ 410, 650, AL 48
*Causus defilipii* X 392, 376, DGB & EVC 75
*Causus lineatus* + 574, 661, RFL 56
*Causus resimus* + 574, 661, RFL 56
*Chamaeleo adolffriederici* X 65, 63, GFW 65
*Chamaeleo anchietae* +++ 71, 90, GFW 65
*Chamaeleo bitaeniatus ellioti* ++ 81, 97, GFW 65
*Chamaeleo bitaeniatus graueri* X 160, 160 GFW 41
*Chamaeleo chapini* ++++ 44, 80, GFW 65
*Chamaeleo dilepis idjwiensis* + 135, 150, GFW 65
*Chamaeleo gracilis* X 163, 160, GFW 65
*Chamaeleo ituriensis* + 102, 114, GFW 65
*Chamaeleo johnstoni* X 128, 127, GFW 65
*Chamaeleo oweni* X 137, 132, GFW 65
*Chamaeleo roperi* + 110, 123, GFW 65
*Chamaeleo rudis* X 74, 74, GFW 65
*Chamaeleo senegalensis* ++ 102, 123, GFW 65
*Chersina angulata* ———— 264, 163, AL & EEW 57
*Chironius carinatus* — 1359, 1196, JRD & PS 77
*Chironius fuscus* — 1385, 1218, JRD & PS 77
*Chrysopelea ornata* + 740, 825, MAS 43
*Cnemidophorus deppei infernalis* — 84, 75, WED & JW 60
*Cnemidophorus guttatus flavolineatus* —— 113, 93, WED & JW 60
*Cnemidophorus lineatissimus duodecimlineatus* —— 92, 72, WED & JW 60
*Coleonyx brevis* X 56, 59, LMK 45
*Coleonyx elegans* X 92, 97, LMK 45
*Coleonyx mitratus* X 91, 88, LMK 45
*Coluber karelini* ++ 610, 710, MAS 43
*Coluber ravergieri* — 875, 785, MAS 43
*Coluber ventromaculatus* — 815, 715, MAS 43
*Coniophanes bipunctatus* ++++ 402, 560, JRB 38
*Corallus caninus* + 908, 1040, WED 78
*Corallus enydris* X 1643, 1700 (totals), JRD & PS 77
*Cordylus capensis* X 100, 98, VFMF 43
*Cordylus coeruleopunctatus* X 80, 79, VFMF 43
*Cordylus giganteus* X 180, 176, VFMF 43
*Cordylus jonesi* + 73, 82, UVP 66
*Cordylus jordani* X 125, 127, VFMF 43
*Cordylus polyzonus* + 113, 110 VFMF 43
*Cordylus tropidosternum* X 86, 88, VFMF 43

*Cordylus vandami* + 118, 132, UVP 66
*Cordylus warreni* ++ 110, 127, UVP 66
*Coronella brachyura* — 440, 395, MAS 43
*Crotaphopeltis degeni* X 463, 447, CRSP 74
*Ctenoblepharis nigriceps* — 89, 75, RDB 66

*Dasypeltis atra* +++ 625, 841, CRSP 74
*Dasypeltis fasciata* ++ 645, 809, CRSP 74
*Dasypeltis medici* ++ 600, 700
*Dendrelaphus ahaetulla* + 735, 820, MAS 43
*Dendrelaphus picta* ++ 725, 910, MAS 43
*Dendroaspis angusticeps* X 1453, 1480, DGB & EVC 75
*Dendroaspis jaimesoni* + 1650, 1901, KPS 23
*Dendroaspis polylepis* X 2330, 2382, DGB & EVC 75; UVP 66
*Diploglossus costatus* — 127, 116, AS 70
*Diploglossus curtissi* — 86, 82, AS 70
*Diploglossus occiduus* —— 305, 256, AS 70
*Diploglossus stenurus* —— 172, 143, AS 70
*Diploglossus warreni* — 230, 218, AS 70
*Dipsadoboa duchesnei* —— 740, 616, RFL 56
*Dipsadoboa elongata* —— 740, 623, RFL 56
*Dipsas pavonina* — 544, 486, JAP 60
*Dipsas variegata* X 640, 639, JAP 60
*Duberria rhodesiana* ++++ 220, 325 VFMF 62
*Duberria variegata* ++++ 176, 280 VFMF 62

*Elaphe helena* ++++ 700, 1060, MAS 43
*Elaphe hodgsoni* —— 1190, 995, MAS 43
*Elaphe taeniura* ++ 1300, 1640, MAS 43
*Elapops modestus* +++ 362, 464, KPS 23
*Elapsoidea guentheri* X 480, 485, RFL 56
*Elapsoidea loveridgei* + 510, 550, CRSP 74
*Elapsoidea loveridgei colletti* + 515, 555, CRSP 74
*Elapsoidea semiannulata* X 605, 603, DGB & EVC 75
*Emoia baudini* X 55, 55, AL 48
*Enhydris boucourti* ++++ 520, 990, MAS 43
*Enhydris chinensis* + 516, 567, CHP 35
*Enhydris plumbea* + 358, 378, CHP 35
*Enyalius bilineatus* ++ 88, 105, RE 69
*Enyalius boulengeri* + 107, 117, RE 69
*Enyalius catenatus* X 107, 107, RE 69
*Enyalius iheringi* ++ 100, 124, RE 64
*Epicrates angulifer* +++ 1743, 2250, BRS & AS 74
*Epicrates fordi* —— 860, 730, BRS & AS 74
*Epicrates gracilis* X 870, 905, BRS & AS 74
*Epicrates striatus* — 2320, 2055, BRS & AS 74
*Eremias argus* + 57, 61, RGW, JKJ & GWB 62
*Eremias breviceps* — 46, 43, RM 55
*Eremias burchelli* + 52, 57, VFMF 43
*Eremias capensis* — 63, 58, VFMF 43
*Eremias lineoocellata* X 57, 55, VFMF 43
*Eremias undata* X 54, 52, VFMF 43
*Eryx conicus* ++++ 445, 855, MAS 43
*Eryx johni* + 800, 920, MAS 43
*Eumeces copei* + 66, 73, JRD 69
*Eumeces dugesi* X 66, 69, JRD 69

*Garthia dorbignyi* X 40, 40, RD 66
*Garthia penai* X 32, 32, RD 66
*Gastropyxis smaragdina* ++ 562, 682, RFL 56
*Gecko japonicus* ——— 60, 43, YO 36
*Gecko vittatus* X 93, 95, AL 48
*Geochelone pardalis* +++ 302, 432, RM 55
*Geochelone pardalis babcocki* + 364, 385, RM 55
*Gerrhosaurus flavigularis* X 126, 133, *var.*
*Goniocephalus modestus* — 87, 83, AL 48
*Gonysoma oxycephala* + 1400, 1600, MAS 43
*Grayia ornata* ++ 892, 1038, KPS 23
*Grayia smythii* X 1321, 1321 (total), CRSP 74
*Grayia tholloni* +++ 475, 605, CRSP 74

*Haplocercus ceylonensis* ++ 315, 380, MAS 43
*Helicops angulatus* ++ 426, 495, JRD & PS 77
*Hemichatus hemichatus* ++++ 635, 865, DGB & EVC 75
*Homopus areolatus* ++ 96, 114, AL & EEW 57
*Homopus boulengeri* X 108, 110, AL & EEW 57
*Homopus femoralis* ++ 133, 157, AL & EEW 57
*Hydrophis brookei* X 920, 890, MAS 43
*Hydrophis coerulescens* — 720, 675, MAS 43
*Hydrophis cyanocinctus* ++ 1370, 1750, MAS 43
*Hydrophis fasciatus* — 1010, 915, MAS 43
*Hydrophis klossi* + 975, 1190, MAS 43
*Hydrophis lapemoides* X 870, 855, MAS 43
*Hydrophis mammillaris* X 730, 755, MAS 43
*Hydrophis obscurus* + 1055, 1090, MAS 43
*Hydrophis ornatus* — 835, 780, MAS 43
*Hydrophis spiralis* + 1480, 1710, MAS 43
*Hydrophis stricticollis* X 910, 960, MAS 43
*Hypnale hypnale* ++++ 275, 415, HKG 77
*Hypnale walli* — 262, 248, HKG 77
*Hypsiglena torquata* +++ 479, 642, WWT 44

*Ichnotropis bivittata* + 50, 54, GFW 53

*Kinixys belliana* + 193, 207, AL & EEW 57
*Kinixys belliana nogueyi* X 152, 135, AL & EEW 57
*Kinixys erosa* ——— 323, 260, AL & EEW 57
*Kinixys homeana* X 200, 210, AL & EEW 57

*Lacerta tiliquerta* — 65, 59, BL & BB 74
*Lacerta tiliquerta pardii* — 73, 64, BL & BB 74
*Lamprophis aurora* +++ 459, 529, VFMF 62
*Lamprophis inornatus* ++++ 637, 975, VFMF 62
*Laticauda colubrina* ++++ 745, 1275, MAS 43
*Laticauda laticauda* ++ 800, 960, MAS 43
*Leiocephalus barhonensis* —— 74, 60, AS 67
*Leiocephalus barhonensis aureus* —— 79, 62, AS 67
*Leiocephalus beatanus* —— 80, 64, AS 67
*Leiocephalus beatanus oxygaster* ——— 80, 60, AS 67
*Leiocephalus lunatus* —— 67, 55, AS 67
*Leiocephalus lunatus arenicolor* —— 65, 53, AS 67

*Leiocephalus lunatus melaenacelis* X 61, 60, AS 67
*Leiocephalus lunatus thomasi* –– 66, 55, AS 67
*Leiocephalus personatus* –– 79, 62, AS 67
*Leiocephalus personatus actitis* ––– 86, 61, AS 67
*Leiocephalus personatus agraulus* –– 74, 60, AS 67
*Leiocephalus personatus budeni* –– 66, 52, AS 67
*Leiocephalus personatus mentalis* –– 72, 58, AS 67
*Leiocephalus personatus scalaris* –– 82, 63, AS 67
*Leiocephalus personatus tarachodes* –– 75, 63, AS 67
*Leiocephalus personatus trujilloensis* –– 78, 60, AS 67
*Leiocephalus vinculum* – 77, 73, AS 67
*Leiocephalus vinculum altavelenus* – 71, 63, AS 67
*Leiolepis belliana* – 124, 115, RM 61
*Lepidochelys olivacea* + 730, 790, AEC 52
*Leptodeira annulata ashmeadi* ++ 525, 615, WED 58
*Leptodeira annulata cussiliris* +++ 510, 670, WED 58
*Leptodeira annulata rhombifera* ++ 515, 630, WED 58
*Leptodeira frenata* ++ 464, 576, WED 58
*Leptodeira nigrofasciata* + 430, 473, WED 58
*Leptodeira polysticta* ++ 520, 700, WED 58
*Leptodeira punctata* + 410, 445, WED 58
*Leptodeira septentrionalis* +++ 595, 774, WED 58
*Leptodeira septentrionalis ornata* +++ 500, 665, WED 58
*Liolaemus constanzae* – 61.5, 54, RD 66
*Liolaemus fuscus* – 50, 46, RD 66
*Liolaemus lemniscatus* – 52.4, 49.5, RD 66
*Liolaemus magellanicus* X 60, 62, RD 66
*Liolaemus monticola* X 61, 63, RD 66
*Liolaemus nigroviridis* – 74, 64, RD 66
*Liolaemus pictus* X 64, 62, RD 66
*Liolaemus platei* –– 53, 44, RD 66
*Liolaemus tenuis* X 54, 55, RD 66
*Liopeltis calamaria* ++ 227, 290, MAS 43
*Liopeltis frenatus* – 525, 450, MAS 43
*Liopeltis rappi* X 340, 330, MAS 43
*Liopeltis scriptus* X 310, 320, MAS 43
*Liopeltis stoliczkae* – 375, 343, MAS 43
*Lycodon aulicus* + 692, 737, CHP 35
*Lycodon jara* + 420, 445, MAS 43
*Lycodon subcinctus* + 710, 820, MAS 43
*Lycodon travancoricus* + 475, 505, MAS 43
*Lycodonomorphus laevissimus* +++ 725, 915, VFMF 62
*Lycodonomorphus leleupi* +++ 580, 750, DGB & EVC 75
*Lycodonomorphus rufulus* +++ 552, 702, VFMF 62
*Lycophidion laterale* X 391, 409, KPS 23
*Lycophidion ornatum* +++ 321, 416, CRSP 74
*Lycophidion semiannule* X 222, 228, VFMF 62
*Lycophidion variegatum* + 320, 340, DGB & EVC 75
*Lygodactylus angolensis* X 31, 32, GFW 53
*Lygodactylus angularis* – 39, 35, GFW 53
*Lygodactylus capensis* X 31, 31, AEL 53
*Lygodactylus picturatus* – 41, 36, GFW 53
*Lygosoma graueri* + 172, 192, GFW 41 (total lengths)
*Lygosoma kilimense* + 54, 59, GFW 53
*Lygosoma luberoensis* – 138, 131 GFW 41 (total lengths)
*Lygosoma solomonis* – 67, 63, AL 48
*Lytorhynchus diadema* – 429, 391, AEL & SCA 70

*Mabuya capense* X 130, 135, VFMF 43
*Mabuya lacertiformis* + 48, 52, AL 53
*Mabuya megalura* +++ 56, 73, GFW 53
*Mabuya perroteti* – 133, 124, GFW 53
*Mabuya quinquetaeniata* ++ 121, 151, GFW 53
*Mabuya quinquetaeniata obsti* X 117, 114, AL 53
*Mabuya rudis* X 76, 77, RM 59
*Mabuya striata chimbawa* + 77, 82, AL 53
*Mabuya striata ellenbergi* X 93, 90, AL 53
*Mabuya sulcata* + 75.5, 81, VFMF 43
*Macropisthodon plumbicolor* ++++ 415, 605, MAS 43
*Malacochersus tornieri* ++ 145, 177, AL & EEW 57
*Mehelya capensis* ++ 1220, 1500, DGB & EVC 75
*Mehelya poensis* ++++ 642, 936, KPS 23
*Mehelya savorgnanii* ++ 884, 1021, RFL 56
*Mehelya stenophthalmus* ++++ 455, 585, RFL 56
*Meizodon coronatus* + 478, 517, CRSP 74
*Meizodon semiornatus* +++ 455, 600, CRSP 74
*Micrelaps boettgeri* ++++ 264, 381, CRSP 74
*Micrurus alleni* ++ 800, 951, JMS & JLV 74
*Micrurus langsdorffi* + 685, 761, JRD & PS 77
*Micrurus nigrocinctus* +++ 575, 760, JMS & JLV 74
*Micrurus spixii* –––– 1315, 820, JRD & PS 77
*Microcephalus cantoris* –– 1410, 1155, MAS 43
*Microcephalus gracilis* + 870, 930, MAS 43
*Miodon christy* +++ 690, 795, GW & RL 47
*Miodon collaris* +++ 501, 630, CRSP 74
*Miodon collaris graueri* + 310, 358, CRSP 74

*Naja haje* – 2125, 1946, DGB & EVC 75
*Naja mossambica* X 1285, 1270, DGB & EVC 75
*Naja naja samarensis* + 843, 921, AEL 64
*Nerodia fasciata clarki* ++++ AHW & AAW 57
*Neusticurus cochranae* + 70, 79, TMU 66
*Neusticurus rudis* X 88, 89, TMU 66

*Neusticurus strangulatus* — 87, 76, TMU 66
*Neusticurus tatei* — 104, 93, TMU 66
*Nucras delalandii* X 99, 99, VFMF 43
*Nucras tessellata* — 84, 76, VFMF 43

*Oligodon barroni* + 280, 310, MAS 43
*Oligodon catenata* X 490, 473, MAS 43
*Oligodon cinereus* + 620, 695, MAS 43
*Oligodon cruentatus* ++ 300, 320, MAS 43
*Oligodon cyclurus* —— 800, 630, MAS 43
*Oligodon melaneus* — 275, 255, MAS 43
*Oligodon splendidus* X 610, 630, MAS 43
*Oligodon taeniatus* + 387, 427, MAS 43
*Oligodon taeniolatus* X 280, 285, MAS 43
*Opheodrys multicinctus* —— 755, 640, MAS 43
*Opipeuter xestus* + 51, 58, TMU 69
*Opisthotropis latouchii* + 395, 419, CHP 35
*Oxybelis argenteus* X 714, 743, JRD & PS 77
*Oxyrhabdium modestum* ++ 449, 521, MAS 43
*Oxyrhopus trigeminus* ++++ 579, 888, JRD & PS 77

*Pachydactylus punctatus* + 38, 42, GFW 53
*Pachydactylus tuberculosus* — 72, 67, GFW 53
*Palmatogecko rangei* ++ 60, 68, VFMF 43
*Pareas margaritiphorus* +++ 270, 395, MAS 43
*Pareas monticola* +++ 430, 500, MAS 43
*Phelsuma laticauda* —— 52, 42, RM 64
*Phelsuma lineata* —— 57, 47, RM 64
*Phelsuma madagascarensis* — 95, 83, RM 62
*Philothamnus heterodermus* ++++ 515, 730, CRSP 74
*Philothamnus heterolepidotus* + 475, 527
*Philothamnus natalensis* ++ 855, 1062, UVP 66
*Philothamnus ornatus* ++++ 420, 515, DGB & EVC 75
*Pholidobolus affinis* — 64, 58, RRM 73
*Pholidobolus macbrydei* X 56, 56, RRM 73
*Pholidobolus montium* ++ 56, 66, RRM 73
*Pholidobolus prefrontalis* + 57, 63, RRM 73
*Phrynocephalus ornatus* X 39.5, 41.5, AEL 59
*Phyllorhynchus browni* — 783, 692, AWH & AAW 57
*Physignathus concinnus* —— 250, 200, MAS 35
*Platysaurus capensis* X 78, 75, VFMF 43
*Platysaurus guttatus* — 88, 84, VFMF 43
*Platysaurus intermedius* — 88, 84, UVP 66
*Platysaurus mitchelli* X 46, 48, VFMF 43
*Praescutata viperina* — 825, 740, MAS 43
*Prosymna bivittata* ++++ 275, 387, UVP 66
*Prosymna jani* ++ 182, 223, VFMF 62
*Prosymna lineata* — 262, 229, VFMF 62
*Prosymna sundevalli* ++++ 247, 362, DGB & EVC 75
*Psammobates oculifer* + 118, 133, AL & EEW 57
*Psammobates tentorius* ++++ 100, 138, AL & EEW 57
*Psammobates tentorius verroxi* ++ 118, 141, AL & EEW 57
*Psammophis angolensis* + 320, 350, DGB & EVC 75
*Psammophis crucifer* X 490, 490, DGB & EVC 75
*Psammophis jallae* —— 762, 640, DGB & EVC 75
*Psammophis punctulatus* — 1080, 972, CRSP 74
*Psammophis subtaeniatus* — 900, 820, DGB & EVC 75
*Pseudaspis cana* X 1105, 1140, DGB & EVC 75
*Pseudemys floridana texana* + 244, 273, AEC 52
*Pseudocordylus microlepidotus* X 134, 136, VFMF 43
*Pseudocordylus wilhelmi* —— 82, 69, UVP 66
*Pseudoxenodon macrops* — 930, 820, MAS 43
*Pseudoxenodon nothus* — 736, 645, CHP 35
*Pseustes poecilonotus* + 1107, 1205, JRD & PS 77
*Python sebae* ++++ 2300, 3685, DGB & EVC 75

*Rhabdophis auriculata* + 352, 372, AEL 70
*Rhabdophis auriculata myersi* X 342, 348, AEL 70
*Rhabdophis himalayana* ++++ 605, 945, AEL 70
*Rhabdophis nigrocincta* X 625, 655, AEL 70
*Rhabdophis nuchalis* ++++ 520, 740, AEL 70
*Rhabdops bicolor* + 475, 530, MAS 43
*Rhadinea brevirostris* — 372, 333, CWM 74
*Rhadinea calligaster* +++ 313, 401, CWM 74
*Rhadinea decorata* + 265, 280, CWM 74
*Rhadinea fulvittis* + 312, 347, CWM 74
*Rhadinea gaigeae* ++ 377, 471, CWM 74
*Rhadinea hesperis* +++ 281, 380, CWM 74
*Rhadinea laureata* ++ 390, 473, CWM 74
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*Rhampholeon spectrum* X 60, 60, GFW 65
*Rhinocheilus lecontei tesselatus* —— 936, 763, AHW & AAW 57
*Rhinoclemys annulata* ++ 165, 197, RAM 71
*Rhinoclemys areolata* + 188, 206, CHE 78
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*Rhinoclemys nasuta* + 196, 223, CHE 78
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*Rhinoclemys pulcherrima manni* ++ 147, 182, CHE 78
*Rhinoclemys pulcherrima rogerbarbouri* +++ 150, 200, CHE 78
*Rhinoclemys punctularia* + 251, 290, CHE 78
*Rhinoclemys punctularia diademata* +++ 163, 208, CHE 78
*Rhinoclemys rubida* —— 230, 179, CHE 78
*Rhinoclemys rubida perixantha* + 141, 156, CHE 78
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*Riopa anchietae* ++ 178, 210, GFW 53
*Riopa sundevallii* X 93, 90, GFW 53

*Salea anamallayana* —— 110, 85, MAS 35
*Salea horsfieldi* —— 95, 75, MAS 35

*Salvadora grahamiae* X 909, 919, AHW & AAW 57
*Scaphiophis albopunctatus* — 949, 880, CRSP 74
*Scapteira knoxii* — 68, 63, VFMF 43
*Scincella reevesi* ++ 41, 48, RGW, JKJ & GWB 62
*Scincus hemprichii* —— 138, 108, ENA & AEL 77
*Sepsina tetradactyla* ++ 71, 90, GFW 53
*Sibon dimidiata* ——— 444, 326, JAP 60
*Sibon nebulata* X 596, 573, JAP 60
*Sibon nebulata leucomelas* X 547, 562, JAP 60
*Sibon sanniola* — 295, 279, JAP 60
*Sibynomorphus mikani* ++ 435, 513, JAP 60
*Sibynomorphus ventromaculatus* + 422, 483, JAP 60
*Spalerosophis diadema* ++ 980, 1225, MAS 43
*Sphaerodactylus cinereus* X 33.5, 35, WED & AS 58
*Sphaerodactylus copei astreptus* X 38, 38, AS 75
*Sphaerodactylus copei pelates* X 40, 40, AS 75
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*Sphaerodactylus rosaurae* X 38, 39, LDW & DEH 73
*Sphenomorphus megaspila* + 91, 96, AL 48
*Strobilurus torquatus* + 97, 106, RE 68

*Tantilla melanocephala* + 251, 273, JRD & PS 77
*Tarentola americana* — 111, 100, AS 68
*Tarentola americana warreni* X 92, 88, AS 68
*Telescopus dhara* ++++ 620, 1035, CRSP 74
*Testudo kleinmanni* + 113, 127, AL & EEW 57
*Thalassophis anomalus* — 720, 670, MAS 43
*Thamnophis rufipunctatus* ++ 627, 760,
*Thelotornis capensis kirtlandi* + 852, 909, VFMF 62
*Trachischium fuscum* ++++ 272, 415, MAS 43
*Trachischium guentheri* +++ 262, 362, MAS 43
*Trachischium laeve* ++++ 255, 390, MAS 43
*Trimeresurus cantoris* ++++ 555, 1010, MAS 43
*Trimeresurus elegans* X 1075, 1065, KK & DK 76
*Trimeresurus erythrurus* ++++ 445, 880, MAS 43
*Trimeresurus flavomaculatus* ++++ 614, 929, AEL 64
*Trimeresurus gramineus* +++ 515, 665, MAS 43
*Trimeresurus jerdoni* ++ 695, 830, MAS 43
*Trimeresurus kaulbacki* + 1115, 1118, MAS 43
*Trimeresurus labialis* + 340, 372, MAS 43
*Trimeresurus macrolepis* ++++ 365, 465, MAS 43
*Trimeresurus malabaricus* +++ 450, 660, MAS 43
*Trimeresurus monticola* ++++ 410, 950, MAS 43
*Trimeresurus microsquamatus* X 917, 955, MAS 43
*Trimeresurus purpureomaculatus* ++++ 540, 760, MAS 43
*Trimeresurus strigatus* + 315, 358, MAS 43
*Trimeresurus tokarensis* —— 1190, 960, KK & DK 69
*Trimeresurus trigonocephalus* ++++ 510, 705, MAS 43
*Trimeresurus wagleri* X 679, 679, AEL 64
*Trimorphodon lyrophanes* + 912, 1026, LMK 40
*Tropidophis haetianus* X 468, 480, AS 75
*Tropidophis nigroventris* + 303, 334, AS 75
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*Tropidurus theresiae* X 70, 67, RM 56
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*Uracentron azureum guentheri* X 75, 75, RE 68
*Uracentron azureum werneri* X 60, 58, RE 68
*Uranoscodon superciliosa* X 138, 135, MSH 73
*Uromacer catesbyi* ++ 685, 830, AS 70
*Uromacer catesbyi insulaevaccarum* +++ 615, 800, AS 70
*Uromacer catesbyi frondicator* +++ 688, 755, AS 70
*Uromacer catesbyi hariolatus* ++ 645, 790, AS 70
*Uromacer catesbyi inchausteguii* ++++ 590, 795, AS 70
*Uromacer catesbyi pampineus* +++ 610, 770, AS 70
*Urostrophus torquatus* X 92, 95, RDB 66

*Varanus komodoensis* ——— 3030, 2270, WK 69 (total lengths)
*Vipera superciliaris* + 513, 552, VFMF 62

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*Wetmorena haetiana surda* X 81, 81, AS 65

*Xantusia henshawi bolsoni* + 50.8, 56.8, RGW 70
*Xenocalamus mechowi* ++++ 487, 685, DGB & EVC 75
*Xenocalamus sabiensis* ++ 400, 470, DGB & EVC 75
*Xenochrophis punctulata* ++ 395, 470, MAS 43
*Xenodon rabdocephalus* ++ 628, 750, JRD & PS 77
*Xenopeltis unicolor* ++ 780, 955, MAS 43
*Xylophis perroteti* ++ 480, 580, MAS 43

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